

CORRECTIVE ACTION

Should there be non-compliance with the stated performance indicator the following corrective actions are to be implemented.

- Identification of the cause of the non-compliance;
- Implementation of appropriate mitigation measures as determined by the Developer and Consultant in consultation with the Contractor; and
- Relevant validation monitoring to confirm that the nominated corrective actions have been effective.

The Contractor shall implement the corrective action(s) as required within the agreed time frame noted on the CAR.

10. ELEMENT 8: CONTINGENCY PLAN

RATIONALE

To avoid detrimental impact on the receiving environment external to the site as a result of unplanned or emergency events associated with the works.

OBJECTIVE / TARGET

To effectively manage unplanned or emergency events at the site.

TASKS / ACTIONS

The Contractor is to address the issue of unplanned or emergency events in its Site Works Plan required under Element 1 of this EMP.

The Contractor is to ensure that all management strategies detailed in the Site Works Plan are complied with at all times during the conduct of the works.

The following tasks shall be actioned in the event of unplanned or emergency events occurring during the works.

Heavy or Prolonged Rainfall

Construction phase stormwater treatment and conveyance measures employed at the site are expected to be adequate for rainfall events up to a 1 in 10 year rainfall event. In the event that heavy or prolonged rainfall occurs beyond this event magnitude at the site during the works, the following actions shall be implemented.

1. The Contractor shall make an initial assessment of the possible impacts of the rain based on weather forecasts and current site conditions.
2. If the assessment concludes that the rainfall event will result in an increased risk of stormwater contamination, then the Contractor shall cease works at the site.
3. The Contractor shall take actions to ensure that erosion and sediment control measures in place over the site are performing adequately and that stormwater discharges from the site meet the release criteria specified in Element 3. Actions shall also be taken to ensure that all materials being stored at the site including fuels and lime are secure and there is no risk of accidental release or stormwater contamination.
4. If required, the Contractor shall make necessary repairs, alterations or additions to the erosion and sediment control devices and the storage sheds at the site.
5. The Contractor shall only recommence at the site only after the site has been assessed and it has been determined that the risk of erosion and sedimentation has returned to normal and all erosion and sediment control measures have been assessed and repaired / replaced as required.

Accidental Release of Material

In the event that accidental release of material occurs at the site during the works, the following actions shall be implemented.

1. The Contractor shall take appropriate steps to contain the released material. This shall include the use of accidental spill kits located adjacent to stored materials.
2. The Contractor shall make an initial assessment of the severity of the accidental release and the nature of the material.
3. The Contractor shall notify the NSW EPA, the Developer and the Consultant of any accidental release of material.
4. The Contractor shall take steps in consultation with the NSW EPA to treat, remove or otherwise manage the released material.
5. The Contractor, NSW EPA, Developer and Consultant shall make an assessment of the area to confirm the success of the remediation works and whether additional works are required.
6. The Contractor shall assess the work procedures or cause of the failure and implement any changes deemed to be appropriate to prevent reoccurrence of a similar incident in the future.
7. Following completion of remedial actions the Contractor shall provide an incident report or CAR to the Developer detailing the nature of the incident and the corrective actions implemented.

Construction is Halted Due to Unforeseen Circumstances

In the event that construction works are halted due to unforeseen circumstances, to ensure that environmental deterioration does not occur over time the Contractor shall ensure that all erosion and sediment control devices are intact and operational.

Prior to vacating the site, the Contractor shall ensure that all stockpiles are adequately stabilised and the total disturbed area is minimised. In addition, any site conditions that could conceivably degrade over time and may result in environmental harm shall be attended to.

The Contractor shall monitor and maintain the erosion and sediment control devices on a continual basis until work re-commences at the site.

PERFORMANCE INDICATORS

No adverse environmental impacts associated with unplanned or emergency events of any type to be experienced on the site at any time during the works.

All CARs are to be actioned closed out within time frames agreed between the Principal and the Contractor.

All CARs raised in response to actual or imminent potential environmental harm to be actioned within a maximum of 24 hours.

FREQUENCY / DEADLINE

Implementation is to be ongoing for the duration of the works.

REPORTING AND REVIEW

Monthly reports by the Contractor to the Developer on the monitoring during construction, including all corrective action taken to maintain the performance requirement.

CORRECTIVE ACTION

Should there be non-compliance with the stated performance indicator the following corrective actions are to be implemented.

- Identification of the cause of the non-compliance;
- Implementation of appropriate mitigation measures as determined by the Developer and Consultant in consultation with the Contractor; and
- Relevant validation monitoring to confirm that the nominated corrective actions have been effective.

The Contractor shall implement the corrective action(s) as required within the agreed time frame noted on the CAR.

FIGURES

- Figure 1** **Locality Plan**
- Figure 2** **Proposed Development**
- Figure 3** **Constraints Plan**



1.5 0 1.5 3.0 4.5 6.0 7.5km
1:150,000

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Rev: Orig. Date: 22 June 2006

Peter Van Lieshout

CAD FILE: I:\3500-53\ACAD\EMP\Figure 1 - Locality Plan.dwg
XREF's: xr-Cadastre_study_area MGA94, xr-NSW Topo Maps

Scale 1:150,000 (A4)

FIGURE 1 LOCALITY PLAN

Project No.: 3500/53

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CONCEPT PLAN A

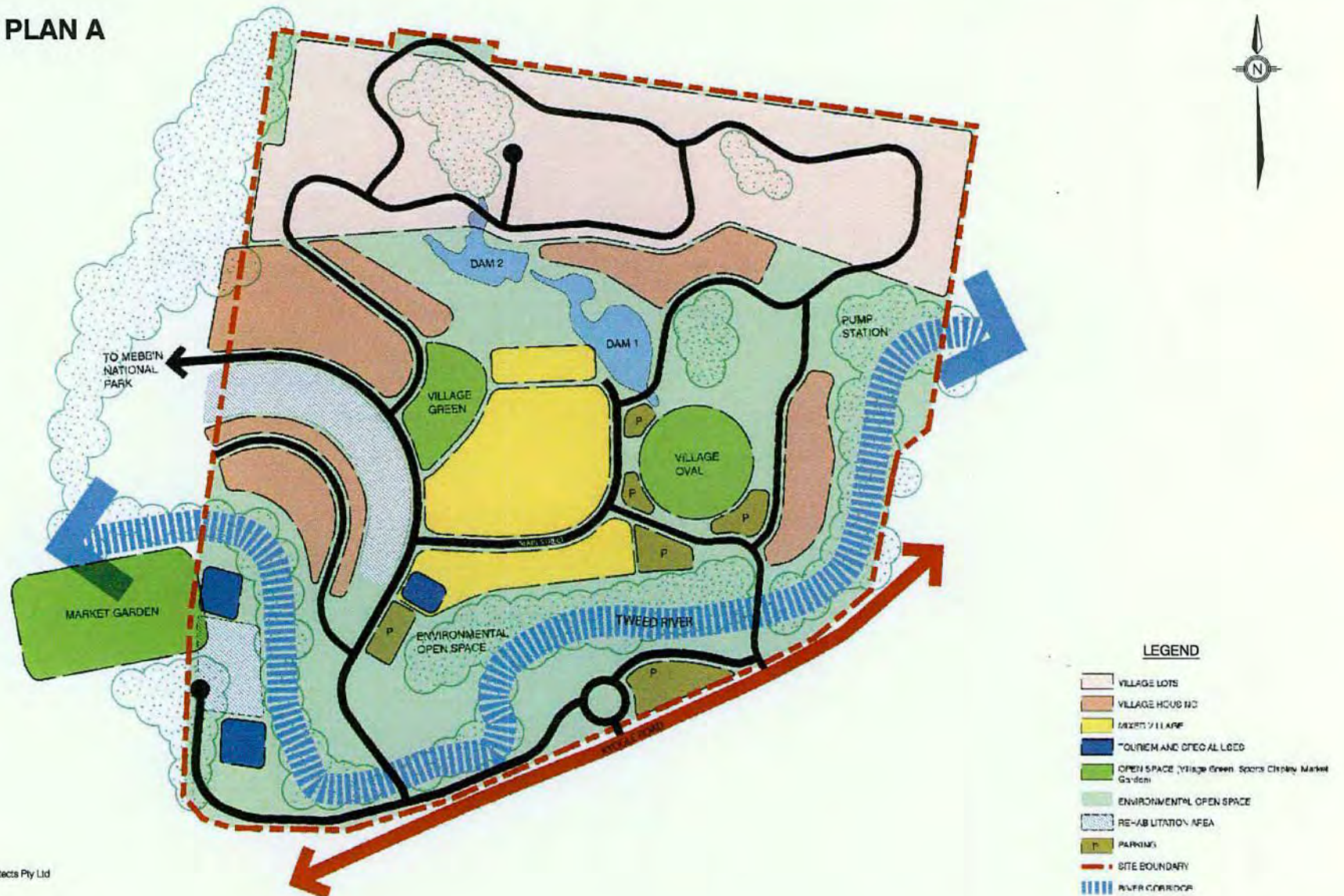


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Project No.: 3500/53
PRINT DATE: 28 Jul 2008 - 9:19am

APPENDIX A

Corrective Action Request Form

CORRECTIVE ACTION REQUEST

Report No: _____

Date: _____

DETAILS OF NON-CONFORMANCE:

Inspected by: _____

DETAILS OF PROPOSED ACTION

Passed to Developer (as applicable):y/n
Reply required by: _____

Date: _____

CONSULTANT/DEVELOPER ADVICE (as required):

Date action required by (if applicable):
Signed (by Developer or Developer's representative): _____

Date: _____

AUTHORITY TO PROCEED

Sign: _____

Date: _____

ACTION CARRIED OUT

Sign: _____

Date: _____

ELEMENT RE-INSPECTED BY

Sign: _____

Date: _____

COPY ISSUED TO DEVELOPER

Date: _____

Sign: _____

APPENDIX B

Waste Register Forms

Waste Register: Site Preparation

Site Material		Destination		
		Reuse and Recycling		Disposal
Type of material	Estimated Volume (m³)	On-site (Specify proposed reuse or on-site recycling methods)	Off-site (Specify contractor and recycling outlet)	Specify disposal facility
Excavation Material (eg sand/soil)		Retain & re-use. Store on-site		
Vegetation Waste		Retain & re-use. Store on-site		
Paper and Cardboard				
Plastics				
Bricks and Tiles				
Concrete				
Timber (provide details)				
Metals (provide details)				
Asbestos containing Material				
Other(Provides details)				
Domestic wastes				

Waste Register: Construction

Site Material		Destination		
		Reuse and Recycling		Disposal
Type of material	Estimated Volume (m ³)	On-site (Specify proposed reuse or on-site recycling methods)	Off-site (Specify contractor and recycling outlet)	Specify disposal facility
Plastics				
Bricks and Tiles				
Concrete				
Timber (provide details)				
Metals (provide details)				
Cables and Wire				
Other (provide details)				
Domestic wastes				

11. NIGHTCAP VILLAGE EARTHWORKS MANAGEMENT PLAN

Cardno - 2006



Nightcap Urban Village

Earthworks Management Plan

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Document Control

Version	Date	Author		Reviewer	
		Name	Initials	Name	Initials
1	17 March 2006	L. Clough/A. Caldwell	LC/AC	C. Sutcliffe	CS
2	21 April 2006	L. Clough/A. Caldwell	LC/AC	C. Sutcliffe	CS
3	28 June 2006	L. Clough	LC	C. Sutcliffe	CS

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NIGHTCAP URBAN VILLAGE EARTHWORKS MANAGEMENT PLAN

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Figure 2	Proposed Plan of Development
Figure 3	Slope Analysis
Figure 4	Contour Survey

APPENDICES

APPENDIX A	Corrective Action Request Form
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EXECUTIVE SUMMARY

This Earthworks Management Plan (EMP) has been prepared on behalf of Peter Van Lieshout for submission with an application for development of Lot 3 on DP771335 and Lot 121 on DP134446 located on the Uki-Kyogle Road, Kunghur, New South Wales.

Management measures are proposed to prevent release of soil and other pollutants from entering stormwater drains or waterways and to mitigate environmental impacts that may occur as a result of erosion and sedimentation during site development. The development is designed to respond to the natural landform and drainage system and prevents significant alteration of existing site characteristics.

Erosion and sediment control measures will be installed prior to earthworks or site disturbance. Control measures will be maintained and repaired as required in accordance with this Earthworks Management Plan to maintain optimum performance throughout construction.

This Earthworks Management Plan has been prepared in accordance with the *Tweed Shire Council Sediment and Erosion Control Guidelines for Builders and Developers* which specifies best practice control measures to be established to minimise surface disturbance and to maintain stability during site development.

This EMP was developed to ensure compliance with the requirements of the *Environmental Planning and Assessment Act 1979* and the provisions of the *Tweed Local Environment Plan 2000* and the *Tweed Shire Council Development Control Plan No. 16 Subdivision Manual*.

1. INTRODUCTION

This Earthworks Management Plan provides erosion and sediment control measures to be implemented during construction of the Nightcap Urban Village at 2954 Kyogle Road, Khungur New South Wales. The site is located 12km southwest of Uki in the Nightcap Ranges and comprises Lot 3 on DP771335 and Lot 121 on DP134446. The site locality is presented in Figure 1.

This Earthworks Management Plan has been developed to prevent the contamination of stormwater and receiving waterways through sediment translocation, as a result of erosion that may occur during earthworks.

2. SITE DESCRIPTION

The proposed Nightcap Village development will involve construction of urban residential and village residential lots including medium density and high density residential precincts. A mixed use precinct will be established in the centre of the site and commercial and health facilities will also be provided. Open space areas will include sports fields, a market garden and village green and general open space areas along the Tweed River.

The site is predominantly cleared of vegetation with scattered trees in the centre area of the site. The dominant vegetation type is flooded gum open forest which forms in sheltered moist locations such as valley floors along watercourses. The boundary of the site has a higher level of remnant riparian vegetation that is associated with the creek lines and the Tweed River.

The neighbouring area to the west of the site is densely vegetated with tall wood forests and wet sclerophyll forests. An area to the northwest of the site is currently leased for revegetation purposes and is also utilised as a camping ground for school groups.

Riparian vegetation and isolated vegetation stands will be retained within the development. Rehabilitation of degraded vegetation in riparian areas of the Tweed River will be undertaken to improve site ecological values and enhance amenity of open space areas. Figure 2 presents the proposed plan of development.

Slopes range from less than 5% to 40-50% with elevations ranging from 70m to 115m AHD as shown on Figures 3 and 4. The development site drains to the northeast through a series of creeks. Byrrill Creek is at the western end of the site, Kunghurloo Creek traverses the centre of the site and the Tweed River traverses the southern portion of the site. Two dams will be constructed within this drainage system as indicated on Figure 2.

3. EARTHWORKS MANAGEMENT

Erosion and sediment control measures shall be installed prior to earthworks or site disturbance. Control measures shall be maintained and repaired as required in accordance with this Earthworks Management Plan to maintain optimum performance throughout construction.

This Earthworks Management Plan has been prepared in accordance with the *Tweed Shire Council Sediment and Erosion Control Guidelines for Builders and Developers* which specifies best practice control measures to be established to minimise surface disturbance and to maintain stability during site development.

3.1 Terminology

The term **Developer** refers to Peter Van Lieshout.

The term **Consultant** refers to the civil and/or environmental engineering consultant employed by the Developer.

The term **Site Manager** refers to the person appointed by the Developer to control on-site operations.

The term **Contractor** refers to the party or company performing construction works relating to the proposed development and includes all employees of the Contractor and sub-contractors.

The term **Works** refers to all matters associated with the construction of the proposed development.

The term **Council** refers to Tweed Shire Council.

The term **NSW EPA** refers to the New South Wales Environmental Protection Authority (Department of Environment & Conservation).

The term **EMP** refers to this Earthworks Management Plan.

3.2 Responsibility

The Site Manager shall be responsible for ensuring that all earthworks are conducted in accordance with this EMP.

The Contractor shall be responsible for ensuring all contractors and sub-contractors are adequately trained in environmental management procedures required by this EMP.

The Contractor shall be responsible for directing site activities and report non-compliance with this EMP to the Site Manager.

3.3 Non-Compliance with the EMP and Corrective Action Requirements

The Contractor shall assume responsibility for implementation of this EMP. Where the Contractor becomes aware of a site or operational condition that does not comply with stated performance indicators of this EMP, there is a requirement for corrective action.

A Corrective Action Request (CAR) form is to be completed and authorised in general compliance with the example CAR form provided in Appendix A of this EMP. The Contractor is also required to maintain a register of CARs, which shall demonstrate that appropriate actions have been completed within a suitable timeframe.

Any CAR registered in accordance with this EMP shall be provided to the Developer, any State or Commonwealth Government Department, any statutory authority or other person, consensually or as lawfully required.

In some instances, further investigation or monitoring may be required to establish whether the Contractor has failed to adequately implement the EMP, or has failed to comply with relevant legislation, guidelines and statutes. In these instances, an independent party such as the Consultant shall carry out the investigation or monitoring. If it is established that the cause for non-compliance with the stated performance indicator(s) has arisen from the Contractor's actions or omissions, then the costs of the monitoring shall be deducted from payments to the Contractor and paid to the Consultant, otherwise the costs of the monitoring shall be obtained from the Developer and paid to the Consultant.

3.4 Legislative and Policy Framework

The following legislation and policies will apply to implementation of environmental management measures under this EMP.

- *Environmental Planning and Assessment Act 1979*
- *Tweed Shire Council Development Control Plan No. 16*
- *Tweed Local Environment Plan 2000*

The *Environmental Planning and Assessment Act 1979* (EPA Act) controls the planning and assessment of land development in New South Wales. The EPA Act encourages the "management, development and conservation of natural and artificial resources" while promoting the "orderly and economic use and development of land".

The *Tweed Local Environment Plan 2000* has been prepared in accordance with the EPA Act and provides a legal basis for preparation of development control plans which contain provisions for land development within the Shire. The *Tweed Shire Council Development Control Plan No. 16 Subdivision Manual* (DCP16). DCP16 outlines Council's objectives for land development and provides guidelines and development standards for new subdivisions.

This EMP was developed in accordance with the provisions of the *Tweed Local Environment Plan 2000* and DCP16. The development responds to the natural landform and drainage system and prevents significant alteration of existing site characteristics in accordance with the requirements of DCP16.

3.5 Objectives

Earthworks undertaken during site development may result in environmental impacts due to vegetation removal and soil disturbance. The objectives of this Earthworks Management Plan is to reduce the potential impacts associated with erosion and sedimentation during earthworks to prevent site destabilisation and to protect the water quality of receiving waterways.

Erosion and sediment control measures shall be provided on the site in accordance with the Tweed Shire Council Development Control Code No. 16 and the *Development and Design Specification D7 – Stormwater Quality and its Annexure A – Code of Practice for Soil and Water Management on Construction Works*.

3.6 Performance Indicators

The Contractor shall ensure that any waters being discharged from the construction site comply with the following water quality characteristics or demonstrate that there is no worsening of existing conditions as determined by baseline water quality monitoring.

Water Quality Parameter	Release Limit
Suspended Solids*	<50 mg/L
pH	4.0 to 7.0
Dissolved Oxygen	> 6mg/L
Hydrocarbons	No visible sheen
Litter	No visible litter
Total Nitrogen	0.3 mg/L
Total Phosphorous	0.03 mg/L

3.7 Design Considerations

The development design has considered the existing topography of the site and minimises earthworks by integrating structures with the landform, where possible, to reduce the risk of environmental impacts. Development works are proposed to be staged to limit the extent of exposed areas at any one time during construction.

3.8 Stabilised Site Access Point

The site shall have a stabilised entry/exit point so that access for construction vehicles and equipment is limited to a single control point. This area shall include a shakedown area and wheel wash to prevent soil-tracking onto external roads. The entry crossing shall be stabilized with geotextile fabric and blue-metal to allow all-weather access.

3.9 Earthworks Actions/Tasks

Erosion and sediment control measures shall be implemented by the Contractor during earthworks/construction. Such measures shall include, but should not be limited to, the following.

- All erosion and sediment control devices shall be installed prior to commencement of construction activities including vegetation removal and cutting and filling.
- Erosion and sediment control devices including sediment traps, sediment retention ponds and any stormwater diversion structures shall be installed to prevent sediments from leaving the site or entering downstream environments.
- Diversion banks or channels shall be installed to direct uncontaminated upslope runoff around the works areas. These drains shall be terminated at silt traps and may require erosion control measures depending on the flow velocity.
- Vegetation clearing shall be undertaken in stages to minimise soil erosion. Topsoil removed during vegetation removal shall be stockpiled at heights of no more than 1.5m and located within designated storage areas. Stockpiled topsoil shall be used in revegetation following completion of earthworks.
- All stockpiles shall be stabilised and sediment fences installed on downhill slopes to prevent mobilisation of stockpile materials into waterways. Grassed areas should be maintained downslope of sediment fences to trap excess materials.
- Any exposed areas within the site shall be contained within erosion and sediment controls.
- When excavating for services installation, trenches shall be left open for a minimum practical time.
- In instances that trenches require pumping dry for pipe installation, the pumped water shall be filtered through a grass buffer or a suitable silt trap prior to discharge.
- All erosion and sediment control measures shall be inspected on a daily basis and immediately following rain to verify optimum performance. Any necessary repairs shall be made immediately.
- Failures in erosion and sediment control devices shall be immediately reported to the Site Manager so that procedures may be revised where necessary.
- Sediment and erosion controls shall only be removed at the completion of earthworks after all surfaces have been stabilised.
- Roads and pavements shall be swept, not hosed as required to prevent entry of soils to stormwater drains or gutters. Sediment controls shall be placed around stormwater drains as a precaution.

3.10 Revegetation / Site Stabilisation

Following construction works, revegetation shall be undertaken by the Contractor as soon as practicable to stabilise exposed areas. Vegetation stabilisation at the development site shall include, but should not be limited to, the following.

- Soil coverage shall be maximised through vegetation cover. This may be achieved through planting of grass, laying gravel, employing an erosion control blanket or matting.
- Buffer areas of vegetation cover to be maintained to the highest level practicable, this is particularly important in areas adjacent to drainage lines. These buffer areas should be fenced to minimise disturbance.
- Down slope vegetation to be maintained as a secondary filtration device for stormwater runoff.
- Landscaping to be undertaken to rehabilitate the disturbed areas within the site. Mulching of open garden beds of the landscaped areas will minimise water losses.
- Following the forming of land, permanent or temporary vegetative stabilisation should be undertaken this may be through utilisation of straw mulch, seeding and planting of flora in all disturbed areas following construction

3.11 Monitoring Requirements

The Contractor shall visually inspect all sediment and erosion controls on a daily basis and following rain and undertake repairs or maintenance where necessary.

The Contractor shall visually inspect the integrity of stockpiles on a daily basis and following rain.

The Contractor shall inspect all stormwater drains daily and following rain to ensure they are free of debris.

The Contractor shall remove all uncontaminated material from sediment and erosion control devices on a fortnightly basis and following rain. Uncontaminated material shall be returned to a secure stockpile area.

The Contractor shall undertake water quality monitoring in accordance with the Environmental Management Plan prepared for the site.

3.12 Corrective Actions

Should there be non-compliance with the stated performance indicators, the following corrective actions are to be implemented.

- The Contractor shall identify the cause of the non-compliance.
- The Contractor shall implement appropriate mitigation measures as determined by the Developer and Consultant in consultation with the Site Manager.
- The Contractor shall undertake validation monitoring to confirm that the nominated corrective actions have been effective.
- The Contractor shall implement the corrective action(s) as required within the agreed time frame noted on the Corrective Action Request.

FIGURES

- Figure 1** **Locality Plan**
- Figure 2** **Proposed Plan of Development**
- Figure 3** **Slope Analysis**
- Figure 4** **Contour Survey**



1.5 0 1.5 3.0 4.5 6.0 7.5km
1:150,000

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Rev: Orig. Date: 22 June 2006

Peter Van Lieshout

CAD FILE: I:\3500-53\ACAD\Earthworks Management Plan\Figure 1 - Locality Plan.dwg
XREF's: xr-Cadastra_study_area MGA94, xr-NSW Topo Maps

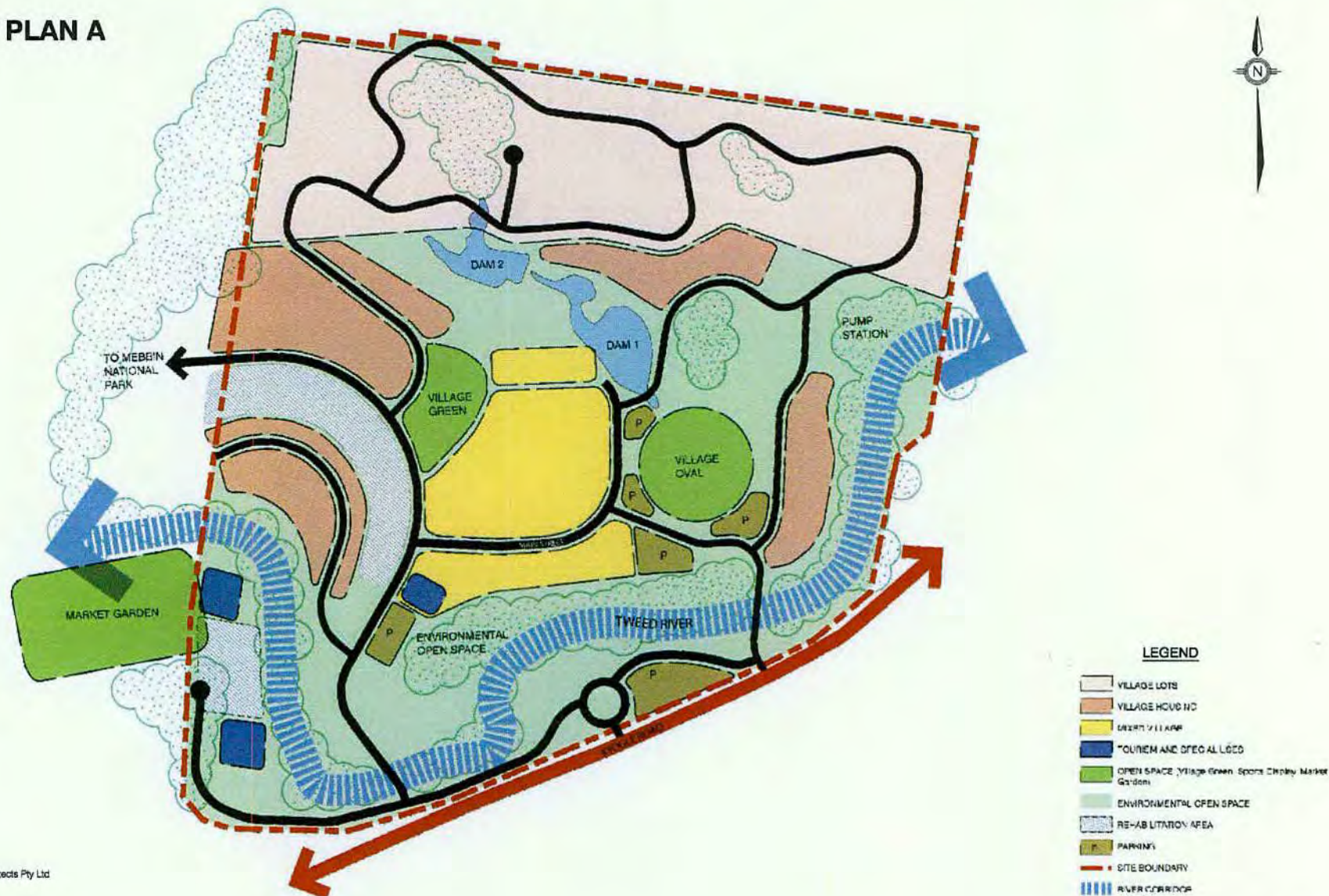
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FIGURE 1 LOCALITY PLAN

Project No.: 3500/53

PRINT DATE: 22 June, 2006 - 15:1pm

CONCEPT PLAN A

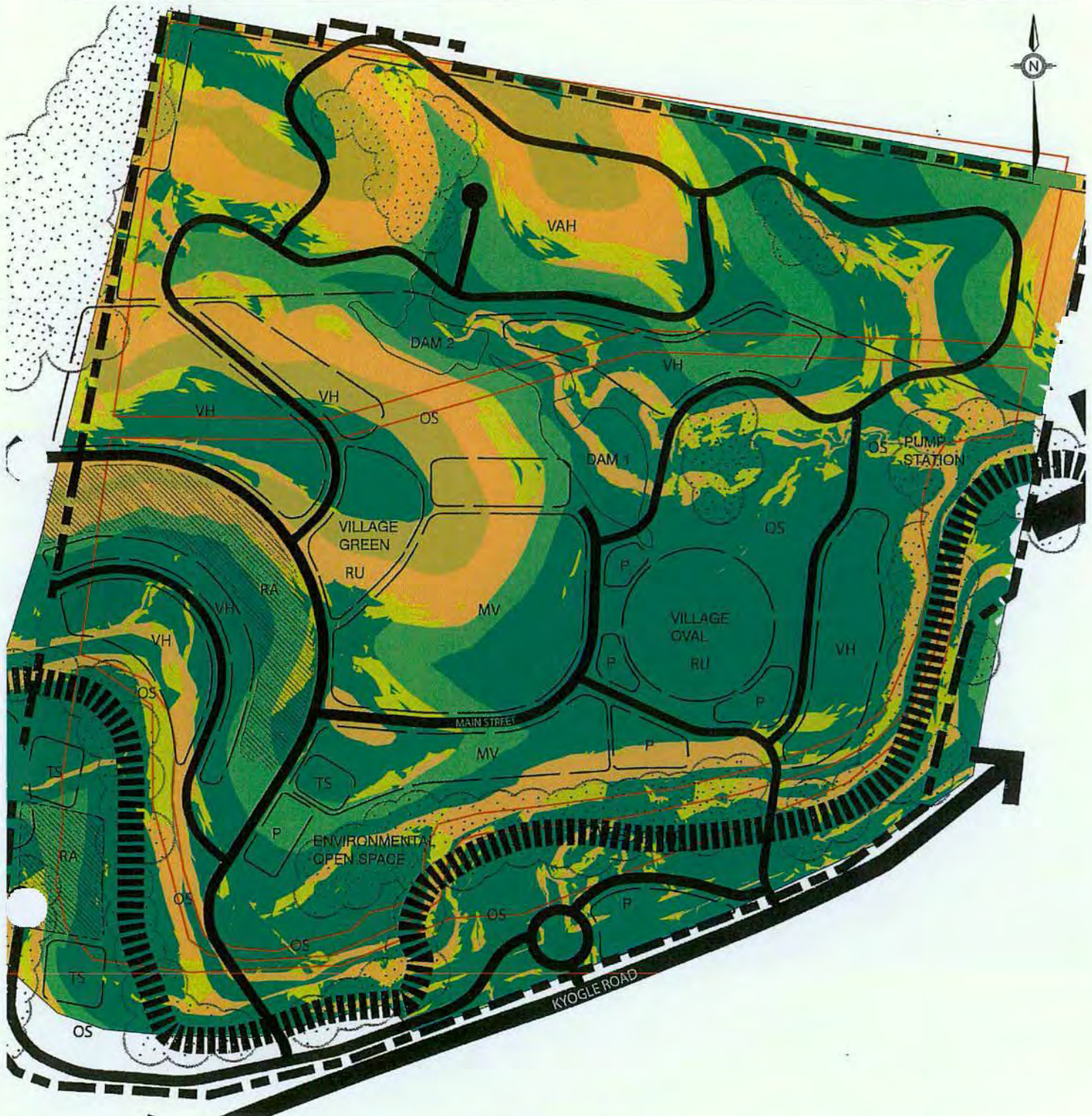


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Peter Van Lishout
CAD FILE: 11586-32/VLAD/Earthworks Management Plan/Figure 2 - Proposed Plan of Development.dwg
XREF:

Project No.: 3500/53
PRINT DATE: 21 June 2006 - 11:44am



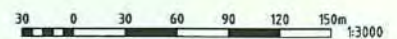
Proportion %		
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16.67	25	24.4
25	100	22.4

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Rev: Orig. Date: 21 July 2006

Peter Van Lijshout
CAD FILE: N3553-33-MACAD-Earthworks-Management-Plan-Figure 3 - Slope Analysis.dwg
XREF:

VAH	VILLAGE LOTS	12.28 Ha
VH	VILLAGE HOUSING	4.94 Ha
MV	MIXED VILLAGE	3.75 Ha
TS	TOURISM AND SPECIAL USES	0.51 Ha
RU	RECREATIONAL USE	1.73 Ha
OS	OPEN SPACE	16.80 Ha
RA	REHABILITATION AREA	2.03 Ha
	ROAD AREA	4.92 Ha
P	PARKING	1.20 Ha
TOTAL SITE AREA		48.16 Ha



Scale 1:3000 (A3)

FIGURE 3 SLOPE ANALYSIS

Project No.: 3500/53

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Rev: Orig. Date: 21 July 2008

Peter Van Lierhout

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APPENDIX A

Corrective Action Request Form

CORRECTIVE ACTION REQUEST

Report No: _____

Date: _____

DETAILS OF NON-CONFORMANCE:

Inspected by: _____

DETAILS OF PROPOSED ACTION

Passed to Developer (as applicable):y/n
Reply required by: _____

Date: _____

CONSULTANT/DEVELOPER ADVICE (as required):

Date action required by (if applicable):
Signed (by Developer or Developer's representative): _____

Date: _____

AUTHORITY TO PROCEED

Sign: _____

Date: _____

ACTION CARRIED OUT

Sign: _____

Date: _____

ELEMENT RE-INSPECTED BY

Sign: _____

Date: _____

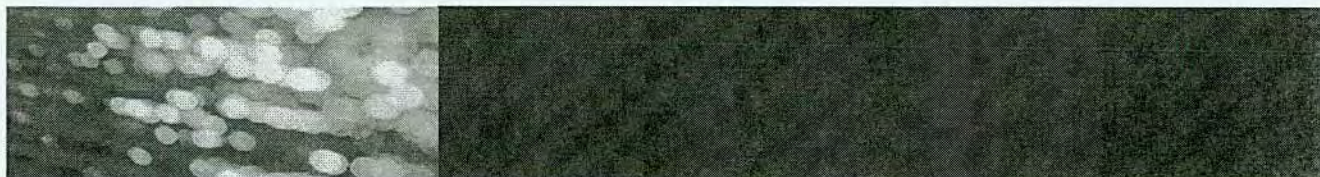
COPY ISSUED TO DEVELOPER

Date: _____

Sign: _____

**12. NIGHTCAP VILLAGE INVESTIGATION OF WATER SUPPLY AND
EFFLUENT DISPOSAL OPTIONS**

Cardno - 2006



Nightcap Urban Village

Investigation of Water Supply and Effluent Disposal Options

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**NIGHTCAP URBAN VILLAGE
INVESTIGATION OF WATER SUPPLY
AND EFFLUENT DISPOSAL OPTIONS**

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EXECUTIVE SUMMARY

It is proposed to develop a site on Kyogle Road in the Kunghur area of north-eastern New South Wales to create a residential village. The site falls within the jurisdiction of Tweed Shire Council.

The development will be a rural village style comprising normal detached residential dwellings, village residential, mixed village development and community facilities, fully integrated into the surrounding environment.

This report describes an investigation into the water supply and sewerage infrastructure required for the development.

Water sensitive urban design principles have been observed in the proposal.

For the village lot housing area, rainwater tanks of 45 kilolitres minimum capacity per lot are recommended. Provided the full roof area is drained to the tanks, they will provide the full domestic requirements with a suitably high reliability of supply. Use of rainwater tanks will help to counteract the increases in runoff intensity that results from urbanisation.

For the mixed village, and village housing style development, rainwater tanks of minimum capacity 20 kilolitres are recommended. For the community facilities, a tank size of 10 kilolitres per 45 square metres of roof area is recommended. Because of the limited roof area in these types of development, rainwater supply will only provide about half of the domestic water demand with acceptable reliability; therefore a supplementary reticulated supply is proposed. Treated water supply from the two small storages located to the north of site will be reticulated to the dwellings. The supply from these two dams will provide 50% of the demand of the mixed village, village residential areas and community facilities with high reliability.

An option would could be considered is a separate reticulated supply of recycled water to the village lot housing, mixed residential, village residential, and community facilities to provide water for toilet flushing and outdoor uses. This has not been allowed for in water supply calculations, but if constructed, will reduce the demand on rainwater tanks and the surface water supplies.

The whole development will be sewered, and the effluent treated to a high standard (suitable for unrestricted irrigation, toilet flushing, and outdoor uses) by a treatment plant using membrane filtration, located to the north of the site. Recycled water from this plant will be used for irrigation of the sports oval, and village green areas, and also for other areas outside the site, including a proposed tree farm. An option exists for part of the treated effluent to be reticulated to dwellings for use in toilet flushing and outdoor uses.

An effluent irrigation area totalling approximately 13.5 hectares will be required, as well as a wet-weather storage of 6.6 megalitres capacity. Adequate areas exist outside of the development area for effluent irrigation. The location of the treatment plant with adequate buffer distances, and the high quality of effluent produced will ensure that there will be odour problems expected.

The proposed water supply and sewerage for the development represents a sustainable solution that will not require facilities external to the development, utilise existing storages, be environmentally compliant, and be in accord with the vision for the development.

1. INTRODUCTION

It is proposed to develop a site on Kyogle Road in the Kunghur area of north-eastern New South Wales to create a residential village. The site falls within the jurisdiction of Tweed Shire Council.

The existing site is characterised by pockets of woodland among open grassland. The development proposal includes residential lots of varying density, and accompanying sports, recreation, hotel and commercial areas. Most of the proposed development will be positioned some distance from the Tweed River which is close to the southern boundary of the site, as a riparian zone has been identified which will also form a buffer between the site and Kyogle Road. Figure 1 shows the location of the development, and Figure 2 is the concept master plan of the development. The riparian zone between the development and Tweed River is indicated on Figure 2.

The site is remote from any existing water supply reticulation area, therefore a water supply will be provided as part of the development. This report describes a preliminary investigation into the sewerage and water supply infrastructure requirements for the development, and from that investigation recommendations are made for the infrastructure required to provide an appropriate standard of service.

2. ESTIMATION OF DEMAND

2.1 Equivalent Population for Water Supply

Information is available on the type of development, and the proposed number of dwellings planned. Based on the most recent concept planning information, the table below lists the type of development, dwelling density and population for the ultimate development.

Table 1 Development types, dwelling and population

Development Type	Approximate Land Area Ha	Dwellings per ha	Yield	Typical Lot Size m ²
Village Lots - Low density residential - detached housing on larger lots	11	15	170	500 - 600
Village Housing - Low-medium density residential - detached, semi attached housing, townhouses, small lot housing	5.1	25	130	250 - 400
Mixed Village - Low-medium and medium density - semi-attached, detached, townhouses and units. Retail uses, hotel, backpackers	3.9	28	110	200 - 350
Tourism - Conference centre, health centre	0.5	20	10	200
Total no of Lots			420	
Predicted population @ 2.2 persons per dwelling			924	

It is understood that the low-density housing development will consist of detached dwellings on larger lot sizes.

The medium development will most likely consist of two or three story cluster housing on small lots, while the Mixed Village development will comprise two and three story dwellings with some commercial areas on the ground floors.

2.2 Water Use per EP

The water use per EP has been determined using the information from the standard for on-site domestic wastewater management (AS/NZS 1547:2000). Appendix 4.2D of that standard suggests a wastewater flow allowance of 140 litres/person/day for households supplied by on-site roof water tank supply or 180 litres/person/day for households supplied by reticulated community or a bore-water supply. In this development, the principal supply is proposed to be by rainwater tank, therefore 140 litres/person/day has been adopted for internal use.

Considering that these volumes are applicable to wastewater flows, the quantity should be increased by some nominal amount to represent the use component for drinking water, cooking, and cleaning. An amount of around 10 litres/person/day is considered appropriate.

For purposes of determining the water requirements for the development, a consumption of 150 litres/EP/day has therefore been used.

Rainwater tanks will provide the water supply to the low-density housing. It is probable that supplementary piped water supply may be provided for toilet flushing and external uses in the low-density housing area, but for the purposes of rainwater tank sizing in this investigation, it is assumed that rainwater tanks will provide the sole supply.

For the medium and mixed development types, a combination of rainwater tank supply and a supplementary supply will be necessary.

It may be possible to reduce the per EP consumption, by measures such as use of full water reduction facilities, however given the nature of the development, and the fact that water use information for similar types of developments with rainwater tank supplies is virtually non-existent, it is recommended that a consumption of 150 litres/EP/day be used for initial planning purposes.

It is recommended that water use for early stages of the development be monitored. This information could be used for more detailed water supply planning for later stages of the development, and appropriate measures could be taken to ensure sustainability of the supply.

2.3 Total Water Demand

The ultimate population of the development is proposed to be approximately 930 people, based on an average of 2.2 people per dwelling. The development will occur in three stages, and the staging plan is shown in Figure 3. Based on the staging plan, and the ultimate development, the water demand per stage and the ultimate water demand will be approximately as listed in the following table.

Table 2 Estimates of Water Demand

Stage	Development Type	Estimated EP*	Total Domestic Water Demand** (kL/day)	Reticulated Supply Component (kL/day)
Stage 1	Village Lots	246	36.9	-
	Village Housing	121	18.1	9.1
	Mixed Village	242	36.3	18.2
Total Stage 1		609	91.3	27.3
Stage 2	Village Housing	128	19.2	-
	Village Housing	31	4.6	2.3
Total Stage 2		159	23.8	2.3
Stage 3	Village Housing	134	20.1	10.1
	Tourism – Special Uses	50	7.5	3.7
Total Stage 3		184	27.6	13.8
Total		952	142.7	43.6

Note: * Assumes 2.2 EP per dwelling
** Internal domestic use

For development other than the village lots, it has been assumed that rainwater tanks will supply part of the demand, supplemented by the reticulated supply. The reticulated supply demands are included in Table 2.

3. RAINWATER TANK SUPPLY

Some analyses of the reliability of water supply from rainwater tanks have been carried out for the different types of development. The analysis has been based on a daily water balance for a single dwelling with a rainwater tank.

Daily rainfall information for the area (sourced from the Silo Datadrill interpolated daily rainfall database maintained by Qld Department of Natural Resources Mines & Water) for the historical period 1950 to 2005 was used in the analysis.

The reliability of supply was estimated for a range of combinations of rainwater tank size, roof contributing area, and daily water demand. In the analyses, it was assumed that the first 1 mm/day of rainfall was interception loss, and the next 0.2 mm was lost to a first flush device.

Appendix A is a summary of results for a range of roof areas, tank sizes and household demands. The results are expressed in the terms of (a) % time of shortfall, which is the % of time during the 56 year period that the supply would fail, and (b) the average annual shortfall in kilolitres.

3.1 Village Lot Development

For the low-density development, it is assumed that rainwater supply will be the sole supply.

The roof areas are expected to be fairly large for this type of development. Assuming that a roof area of 150 m² or greater can be drained to the rainwater tanks, a tank size of 45,000 litres (approx 10,000 gallons) or greater would be required to give an acceptable reliability of supply as a sole water supply.

For a roof area of 200 m² and tank volume of 45,000 litres, based on the water balance, very minor shortfalls in supply would have been experienced in 2 of the 56 years, therefore a tank (or tanks) with total capacity of 45,000 litres or greater will be desirable in this area, to provide a supply of adequate reliability.

It should be possible to accommodate a rainwater tank (or tanks) of total 45,000 litres or greater on these larger lot sizes.

3.2 Mixed Village and Village Housing Development

Roof area and sites available for rainwater tanks will be limited in this type of development, therefore some supplementary supply will be necessary. The supplementary supply is proposed to be treated supply from a number of existing and proposed small dams on or near the development site.

Based on typical patterns of domestic household usage, approximately half of the total domestic demand can be attributed to the kitchen and bath/shower usage. The remaining half of the demand is attributed to toilet and laundry usage.

It is proposed that dual plumbing be provided. Rainwater tank supply will provide for kitchen and bath/shower use, while the external supplementary supply will be piped to toilet and laundry.

With this arrangement, the demand from rainwater tanks per household is estimated to be about 165 litres/dwelling/day (about half the total demand).

If a roof catchment area of 90 m² per dwelling is assumed, a rainwater tank volume of 20,000 litres per lot will be required for an acceptably reliable supply. A 2.6-metre high 23,000 litre tank would take up an area of about 10.5 m².

It should be possible to integrate rainwater tanks with the proposed village type housing in the development. An option would be to provide a common rainwater tank storage to serve a group of houses, but this would require additional reticulation and collection pipework.

An option exists for the treated effluent from the development (recycled water) to be piped via a dual reticulation system to the mixed village and village housing development for toilet flushing and external uses. This would reduce the demand on the rainwater tank and reticulated supply, but would require additional pipework. For the purposes of sizing the rainwater tanks and estimating the supply required from the local water supply storages, it has been conservatively assumed that supply to the mixed village, village residential and community facilities is provided only by on-site rainwater tanks and the treated supply from local water storages.

4. SURFACE WATER SUPPLY

A supplementary supply is required for the village housing and mixed housing developments. The most logical additional supply would be from the existing and proposed dams in and near the development.

4.1 Small Dams

The existing dams are shown in Figure 4. Their details are as follows.

- "Muddy Dam", located to the west of the development site. It is understood that this storage could be utilised for water supply. Muddy Dam has a catchment area of approximately 9.2 hectares, and appears to have a volume of approximately 13 ML, although this would need to be confirmed by survey.
- A small storage ("Dam 3") located just north of the proposed low-density residential area. It is understood that this storage could be utilised for water supply. It has a catchment area of approximately 12.4 hectares, and appears to have a volume of approximately 10.6 ML, although this would need to be confirmed by survey.
- A larger storage ("Dam 4") located north of Dam 3. This is a recently constructed storage, which has a capacity of 55 ML. It has a catchment area of approximately 21 hectares. This storage could also be used for water supply purposes.

The two proposed storages within the development ("Dam 2" and "Dam 1") will have a combined volume of approximately 15.2 ML, based on the latest information. The catchment area of the most downstream of these storages is approximately 41.6 ha, while the upstream storage has a catchment area of approximately 37.8 hectares.

Part of the catchment area of these dams will include the village housing, mixed village, and low-density areas of the development. The contributing impervious area (including pavement, driveways etc, but excluding roofs) to the proposed dams will total approximately 2.1 hectares.

Preliminary estimates of the supply available from these storages have been made using the available catchment and storage information, and the rainfall and evaporation information from Silo Datadrill. The runoff into the storages has been estimated using the US Conservation Service USDA model.

The historical no-failure yield has been estimated for each of the storages. The historical no-failure yield of a storage is the maximum annual supply available without any failures in supply occurring over the historical period of analysis – in this case 1950 to 2005. These estimates are listed in Table 4.1.

Table 3 Estimates of Supply available from small dams

Dam	Assumed Capacity (ML)	Historical no-failure Yield (ML/yr)	Comments
Muddy Dam	13.0	4.5	
Dam 3 (north of low-density residential area)	10.5	3.4	
Dam 4	55.0	16.4	
2 proposed storages within the development. (Dam 1 and Dam 2)	15.2	12.2	Ultimate development of catchment assumed. Catchment area upstream of existing storage (Dam 3) excluded.
Totals	38.7	36.5	

The reliable supply available from the 3 existing and 2 proposed small storages totals 36.5 ML/year (100 kL/day).

The supplementary water demand for the mixed village and village housing type developments totals approximately 44 kL/day (16.1 ML/year), assuming that 50% of the total demand of 88 kL/day is met by the supplementary demand as discussed previously.

The combined supply from Dam 3 and Dam 4 would be sufficient to provide the supplementary water supply for the development. Use of these dams is preferable to using Muddy Dam, because of the distance from the development, and is preferable to using Dam 1 and Dam 2 as they collect runoff from the developed area, which could contain pollutants. Dams 1 and 2 also will be a feature of the development, and if they were used for water supply purposes, drawdown would detract from this function.

Should the supply in Dam 3 and Dam 4 not be sufficient for some reason, it would be possible to utilise storage in Muddy Dam or the proposed dams within the development as a back-up supply.

4.2 Reservoir and Reticulation

The supplementary water supply scheme will include a pump and rising main from each dam to the raw water reservoir and treatment plant located on high ground to the west of the development. Water would be treated near here, and reticulated by gravity to the village housing and mixed village areas. The proposed water supply infrastructure is shown in Figure 4.

4.3 Staging of Water Supply Infrastructure

For the initial stage of the development, a pump would be installed at Dam 4, and the rising main from Dam 4 to the water treatment plant constructed. The initial stage of the treatment plant, reservoir and reticulation to the stage 1 area would also be constructed.

As the village lot housing is supplied by rainwater tanks, development of this area could proceed before the water supply headworks and reticulation, which is required for the village housing and mixed village areas.

Later stages would include augmentation of the treatment plant, reticulation to Stage 2 and 3 areas, the inlet works and pump, and pipe connection from Dam 3 to the rising main.

4.4 Fire-fighting

The reticulation pipework will be sized so as to provide water supply for fire-fighting purposes. For this reason, the water supply network will cover the whole development including the village lot housing area.

A reticulated supply will be constructed for the village housing, mixed village and community areas, and hydrants will be installed in these areas as part of the reticulation network.

At this stage, no reticulated supply is proposed for the village lot development, therefore some special provision will need to be made to locate and connect hydrants in the village lot areas to the water supply network.

It will be necessary to consult with local emergency services to select the locations and layout of the fire hydrants within the development. This consultation could best take place at the more detailed design stage when the development layout is firmed up.

5. EFFLUENT TREATMENT AND RECYCLED WATER USE

5.1 Description

A sewage treatment plant is proposed as part of the development. It is proposed to install a treatment plant that will be capable of producing recycled water of Grade A+ standard. Recycled water of Grade A+ standard can be used for the following purposes:

- toilet flushing, outdoor hosing and washdown;
- garden watering;
- irrigation of public spaces with uncontrolled access;
- irrigation of food crops eaten raw; and
- firefighting purposes.

A package treatment plant that includes biological nutrient removal, ultrafiltration and disinfection in the treatment train would typically be required to produce effluent of this standard. A high quality effluent with low nutrient concentrations (Total Nitrogen of the order of 5 mg/l and Total Phosphorus of the order of 1 mg/l) will be produced.

The plant will be located to the north of the development, near a disused quarry. As a significant portion of the site drains eastward, a pump station located in the eastern part of the site will be required to deliver sewage to the treatment plant. The locations of the pump station and the treatment plant are shown in Figure 5.

The plant location is well away from the proposed development (around 500 metres distance) and any neighbouring residences, therefore it is expected that there would be negligible risk of odour problems. The high quality of the effluent will obviate any potential problems relating to odour in the irrigation areas.

While a 240-volt power supply will be available for the treatment plant and relift pumps for the sewerage system, it may be necessary to have a separate back-up power supply as it is understood that the power supply in this area is somewhat unreliable.

5.2 Hydraulic Loading

The total hydraulic loading of the sewage treatment plant is expected to be of the order of 100 to 140 kL/day (36 to 51 ML/yr) for the ultimate development of the site.

This assumes a population of approximately 1000 and a discharge of 140 litres/EP/day. The loading could be less if there were some grey-water reuse for landscaping by individual landholders in the development. This would depend on the local regulations.

5.3 Effluent Disposal Areas

Treatment of the effluent to a standard allowing use for irrigation in areas with unrestricted public access is proposed.

Based on a preliminary assessment of the loading rate, and the typical quality of effluent, an area of approximately 13.5 hectares would be required for land disposal of the effluent without causing detriment to the soils through excessive hydraulic and nutrient loading.

The actual minimum disposal area would need to be determined when more information was obtained on the soil types and soil properties in the proposed disposal areas, the standard of the treatment, and the quality of effluent.

The treated effluent could be reused for landscape irrigation of areas such as the town green, road verges and the sports and recreation area, which appear to have a total area of approximately 2.5 hectares. A market garden is planned as part of the development, and this could be irrigated with the recycled water. The treated effluent could also be provided at some appropriate charge to individual landholders for their landscaping requirements. Areas suitable for effluent irrigation have been identified to the north and east of the development. These areas are shown on the sewerage infrastructure plan Figure 5.

It appears that there will be adequate areas available for disposal of the treated effluent.

Irrigation of the village green and sports oval areas will most likely be by sub-surface drip, or a pop-up sprinkler system. The irrigation areas outside the development area would probably be irrigated by a solid-set irrigation system or by travelling irrigators. The choice of system will be determined by factors such as land slope, soil type, public access, and cost.

5.4 Wet Weather Storage Requirements

A wet weather storage would be required to store the treated effluent during wet weather periods when irrigation was not possible, and to act as buffer to absorb differences in plant output, and irrigation use. The size of wet weather storage required depends generally on the allowable frequency of overflow of the storage, the area irrigated and climatic factors.

The New South Wales EPA effluent irrigation guidelines indicate that for full reuse schemes where there is no effective discharge to receiving waters and the strength of the effluent is low, uncontrolled releases from the wet weather storage may be allowed in 50% of years.

Some preliminary analyses have been completed using the Medli model to size the buffer storage, so that uncontrolled overflows do not occur in more than 50% years. Medli is a model for designing and analysing an effluent disposal system using land irrigation. It was developed for the CRC for Waste Management and Pollution Control.

Preliminary information on soil and crop types was assumed for the analysis. It was determined that for the ultimate development, with 51 ML/year effluent production, and irrigation of 13.5 hectares, a buffer storage of approximately 6.6 ML would be required. This is approximately 47 days' storage. If the irrigation area were larger, the wet weather storage required could be smaller. The irrigation area and wet weather storage could be refined at a more detailed planning and design stage.

The preliminary Medli analysis indicated that with an irrigation area of 13.5 hectares, there would be negligible risk of nutrient build-up in the soil. This is to be expected because of the proposed high level of treatment with biological nutrient removal.

5.5 Staging of Sewerage Infrastructure

The development is planned to proceed in three stages. The approximate effluent output, area irrigated and wet weather storage requirements for each of these stages are listed in Table 4.

Table 4 Staging of Effluent Irrigation Works

Stage	Total EP	Effluent Production (ML/yr)	Irrigation Area Required (hectares)	Wet Weather Storage Capacity (ML)
1	609	31.1	8	4
2	768	39.3	9.5	4.8
3	952	48.6	13.5	6.6

Figure 5 is a preliminary layout showing location of the sewage pump stations, rising mains, treatment plant, effluent storages, irrigation areas and sewer lines.

The stage 1 development will include the sewers in Stage 1 area, stage 1 of the treatment plant, rising main to wastewater treatment plant, wet weather storage tanks and irrigation areas adjacent to the plant, as well as the irrigation areas (sports field and village green) within the development.

Later stages would include plant augmentation, extension to the sewers, gravity main from the storage tank to additional wet weather storage and irrigation areas to the northeast of the site.

6. SUMMARY & CONCLUSION

A preliminary investigation of water supply options for the Nightcap Village development has been carried out. The development will have to provide its own water supply as it is remote from any existing potable supply reticulation networks.

Water supply to the development could be provided from a variety of sources as follows.

a) Rainwater Tank Supply

Rainwater tank supply would provide the sole supply to the low-density residential component. A minimum 45-kilolitre rainwater tank storage would be required, and the roof area draining to the rainwater tank or tanks should be maximised. Ideally a roof catchment of 150 m² or more should be provided. A first flush device should be fitted, and it is recommended that UV treatment units should be installed to treat at least the potable component.

Rainwater tank supply would provide approximately 50% of the supply to the village housing and mixed village developments. It is recommended that the rainwater tank supply be connected to the kitchen and shower/bath outlets. A minimum rainwater tank capacity of 20 kilolitres per residence would be required. The tank could be integrated in the design of the residence. The roof area draining to the tank should be maximized, ideally 90 m² or more. If individual tanks are considered undesirable, then a larger in-ground tank would be constructed to serve a number of residences. This would however require additional reticulation and collection piping.

b) Surface Supply from Small Storages

A treated supply from the existing and proposed surface water storages on the development is proposed. It is recommended that pipelines be constructed from the two existing storages north of the development to an elevated raw water storage just west of the site, from where it will be treated to potable standard and reticulated by gravity to the village housing, mixed village and other communal parts of the development. The supply is estimated to be sufficient to provide about 50% of the requirements for the village style housing. This supply would be connected to the toilet, laundry and minor external outlets in each residence. The reticulation network would be sized to provide fire-fighting flow requirements.

The capacities of the existing and proposed small storages have been estimated approximately. Better survey information would be required to confirm the capacities adopted in the analysis. The storage to the south west of the development and the two proposed storages within the development could be used as a temporary supply if the two storages to the north could not provide adequate supply during drought periods.

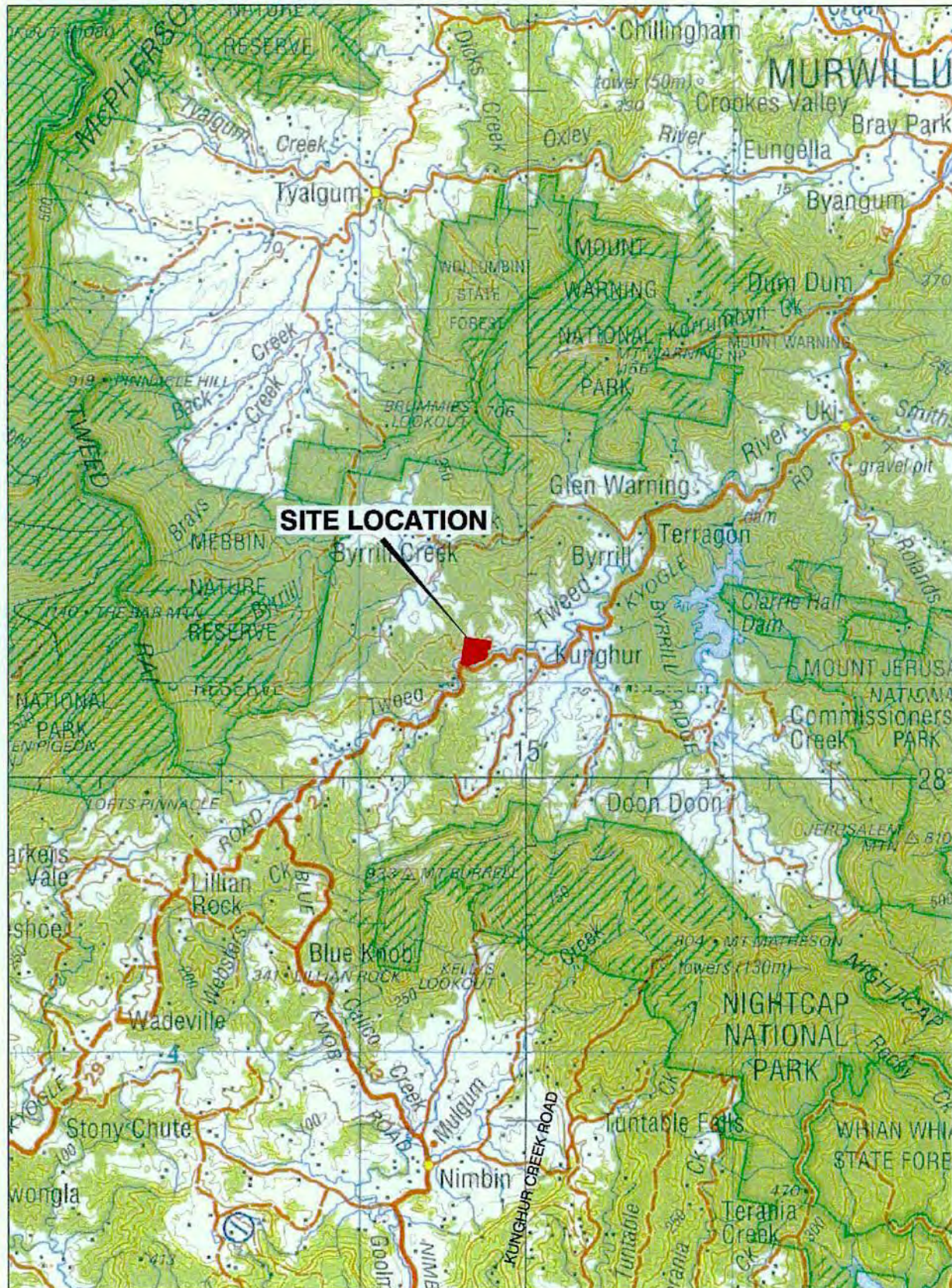
c) Effluent Treatment and Recycled Water Supply

A wastewater treatment plant will need to be constructed to treat sewage effluent from the development. With ultimate development of the site, a plant with a capacity of approximately 50 ML/year will be required. The proposed location for the plant is to the north of the site. A buffer storage with approximate capacity of 6.6 ML would be required for wet weather storage, and a minimum area of approximately 13.5 hectares would be required for land disposal of the effluent. Adequate areas exist within and close to the development for land disposal.

Recycled water (treated to an appropriate standard) from the treatment plant will be used for landscape irrigation of areas such as the sports and recreation area, and the village green. Recycled water from this plant could also be reticulated to individual residences for use in toilet flushing or be sold to individual landholders within the development for their landscape irrigation requirements, however this would require additional reticulation works.

FIGURES

- Figure 1** **Locality Plan**
- Figure 2** **Master Plan of Development**
- Figure 3** **Staging Plan of Development**
- Figure 4** **Proposed Water Supply Infrastructure**
- Figure 5** **Proposed Sewerage infrastructure**



1.5 0 1.5 3.0 4.5 6.0 7.5km
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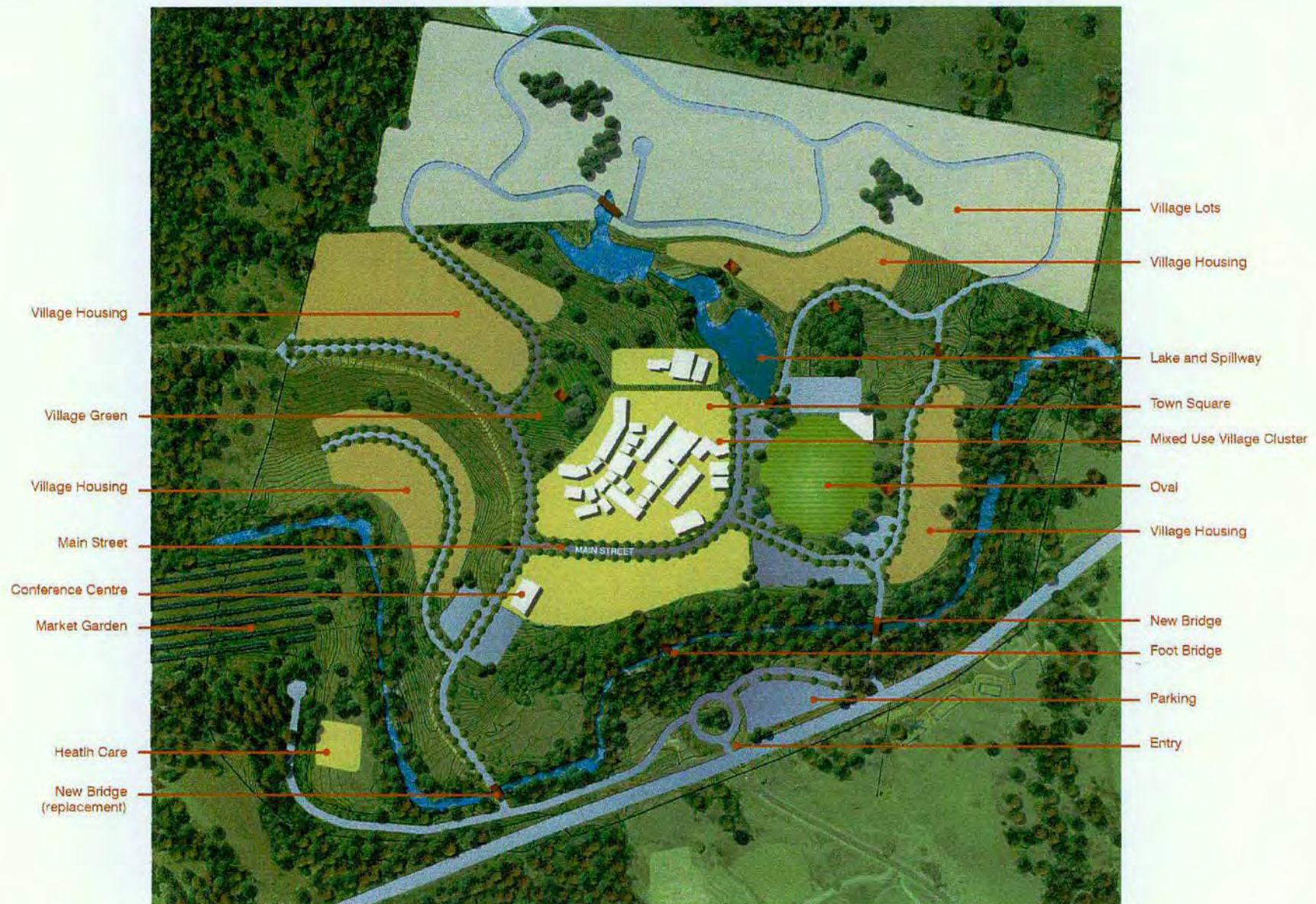
Peter Van Lieshout

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XREF's: xr-Cadastral_study_area MGA94, xr-NSW Topo Maps

FIGURE 1 NIGHTCAP URBAN VILLAGE LOCALITY PLAN

Project No.: 3500/53

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CAD FILE: U3505-52-ACAD-01-Investigation of water supply & effluent disposal options-Figure 2 - master planning
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Master Plan Image Sourced from: Malcolm Middleton Architects Pty Ltd.

N.T.S
FIGURE 2
NIGHTCAP URBAN VILLAGE
MASTER PLAN

Project No.: 3500/53
PRINT DATE: 30 July 2006 - 02:42pm

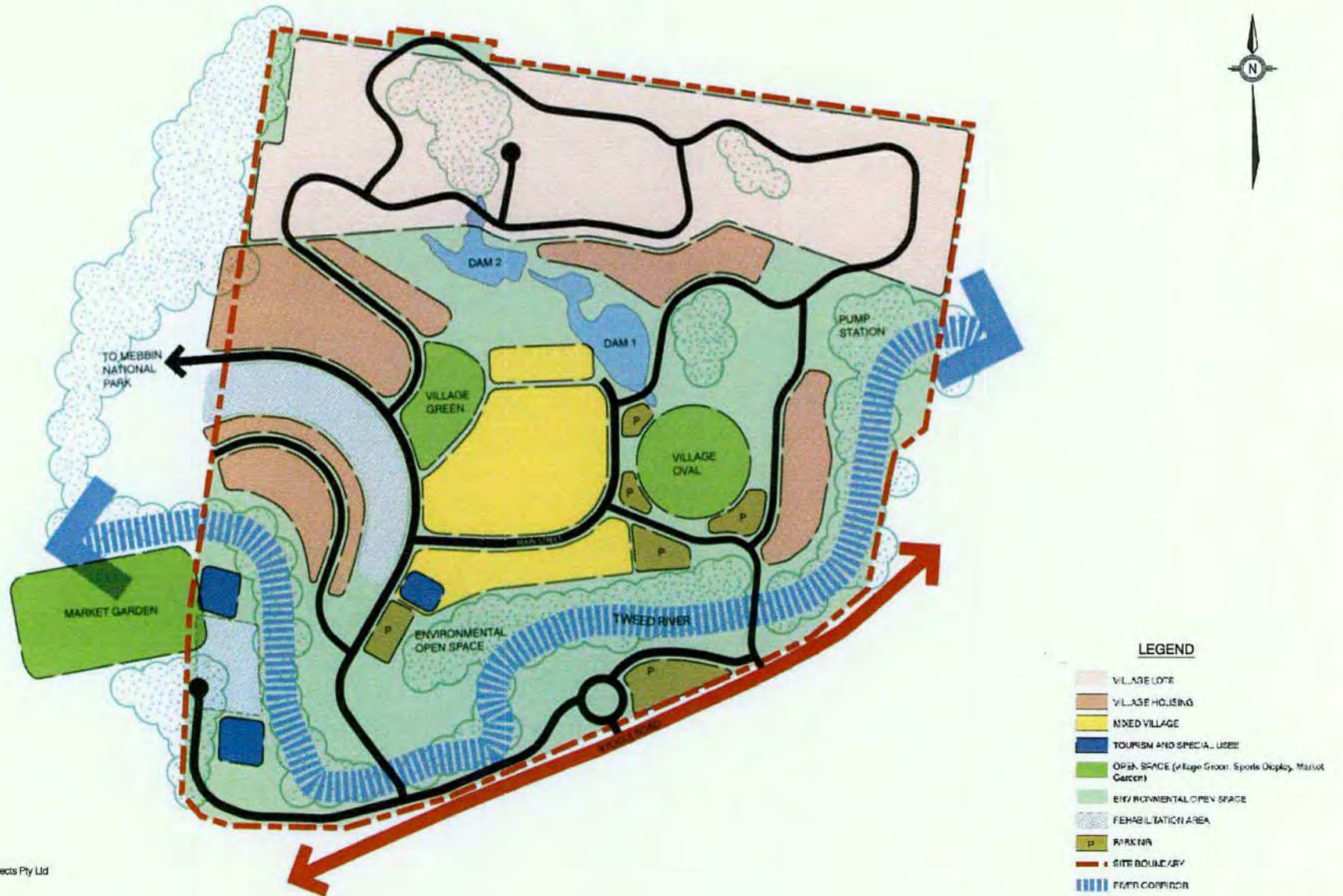


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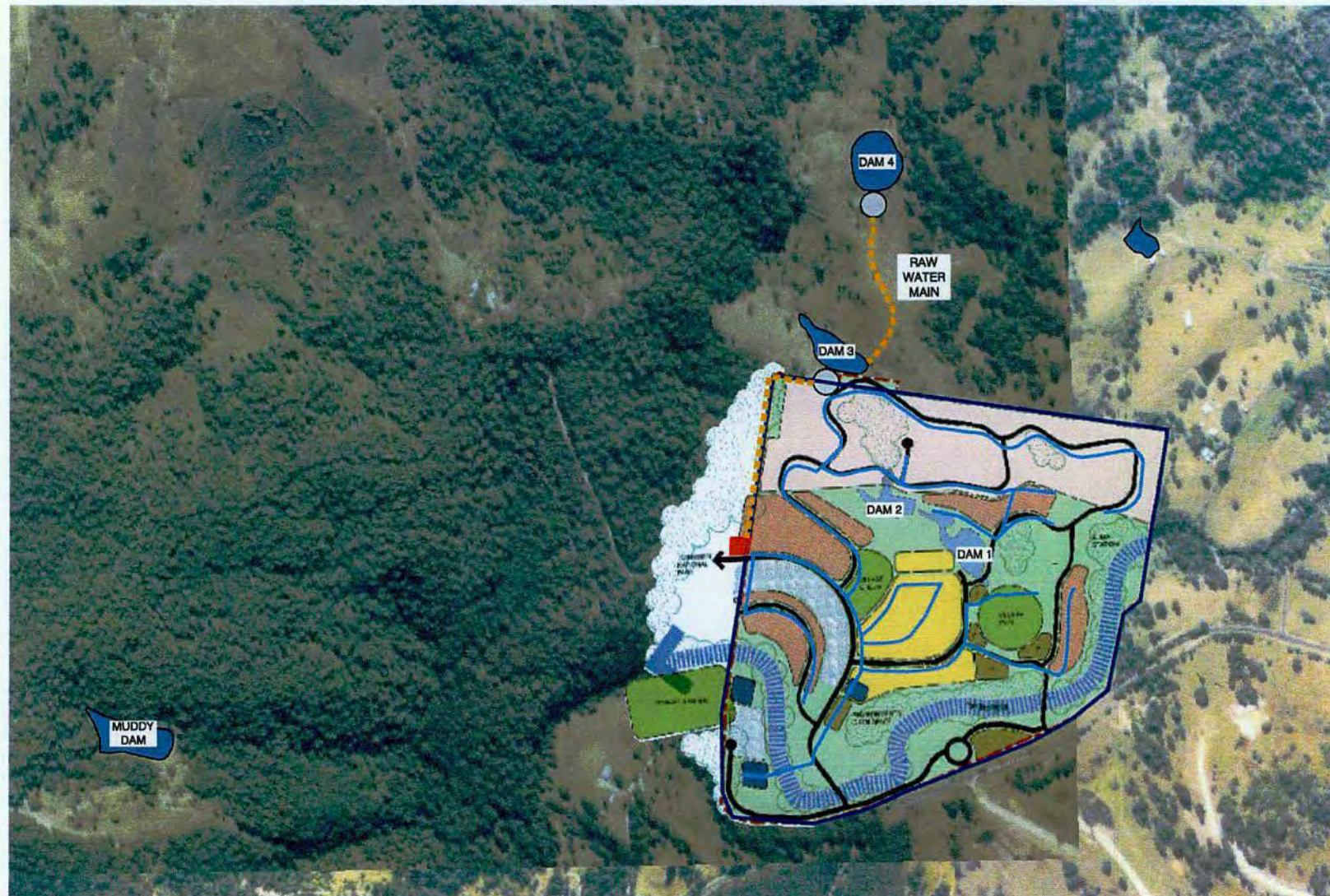
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N.T.S
FIGURE 3
NIGHTCAP URBAN VILLAGE
STAGING PLAN

Project No.: 3500/53
PRINT DATE: 24 July 2006 - 4:32pm

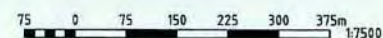
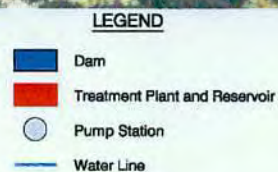


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Aerial Photograph Taken : 26.06.05

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CAD FILE: I:\3504-5304\Investigation of water supply & effluent disposal options\Figure 4 - Proposed Water Supply Infrastructure.dwg
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FIGURE 4
NIGHTCAP URBAN VILLAGE
PROPOSED WATER SUPPLY INFRASTRUCTURE

Project No.: 3500/53
PRINT DATE: 25 July 2006 - 4:53pm



LEGEND

- | | | |
|---|--|---|
|  Potential Irrigation Area |  Sewage Treatment Plant and Wet Weather Storage Tanks |  Storage for Treated Water |
|  Dam |  Pump Station |  Recycled Water Main to Irrigation Areas |
|  Woodlot Water Storage |  Sewer Line |  Rising Main to STP |
|  High Level Storage Tanks | | |

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Date of Aerial photographs: 26-06-05

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CAR FILE 1\3500-53\ACAD\Investigation of water supply & effluent disposal options\Figure 5 - Proposed Sewerage Infrastructure.dwg
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Scale 1:10,000 (A3)

FIGURE 5
NIGHTCAP URBAN VILLAGE
PROPOSED SEWERAGE INFRASTRUCTURE

Project No.: 3500/53
PRINT DATE: 24 July 2006 - 4:31pm

APPENDIX A

Rainwater Tank – Supply Reliability

Water Balance - Summary of Results **Nightcap Village Development**
Estimates of reliability of supply for a single dwelling supplied by rainwater tank

Consumption 75 l/EP/day								
Tank Size (litres)	2.2 per dwelling							
	Roof Size							
	90 m ²		100 m ²		120 m ²		150 m ²	
	% time shortfalls	Av Annual Shortfall (kL)	% time shortfalls	Av Annual Shortfall (kL)	% time shortfalls	Av Annual Shortfall (kL)	% time shortfalls	Av Annual Shortfall (kL)
10000	8.0%	4.5	6.6%	3.8	5.0%	2.8	3.5%	2.0
15000	3.6%	2.0	2.6%	1.5	1.5%	0.9	0.9%	0.5
20000	1.0%	0.6	0.5%	0.3	0.3%	0.2	0.2%	0.1
30000	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0
40000								
50000								

Consumption 120 l/EP/day								
Tank Size (litres)	2.2 per dwelling							
	Roof Size							
	90 m ²		120 m ²		150 m ²		200 m ²	
	% time shortfalls	Av Annual Shortfall (kL)	% time shortfalls	Av Annual Shortfall (kL)	% time shortfalls	Av Annual Shortfall (kL)	% time shortfalls	Av Annual Shortfall (kL)
10000			17.6%	15.9	13.0%	11.8	9.2%	8.4
15000			8.3%	7.6	5.0%	4.5	2.8%	2.5
20000			3.5%	3.1	1.2%	1.1	0.4%	0.4
30000			0.8%	0.8	0.1%	0.0	0.0%	0.0
40000			0.3%	0.3	0.0%	0.0	0.0%	0.0
50000			0.0%	0.0	0.0%	0.0	0.0%	0.0

Consumption 150 l/EP/day								
Tank Size (litres)	2.2 per dwelling							
	Roof Size							
	90 m ²		120 m ²		150 m ²		200 m ²	
	% time shortfalls	Av Annual Shortfall (kL)	% time shortfalls	Av Annual Shortfall (kL)	% time shortfalls	Av Annual Shortfall (kL)	% time shortfalls	Av Annual Shortfall (kL)
10000					20.4%	23.2	14.7%	16.8
15000					15.1%	17.2	9.8%	11.2
20000					11.4%	12.9	6.6%	7.5
30000					6.1%	6.8	2.6%	3.0
40000					2.8%	3.1	0.5%	0.6
45000					1.6%	1.8	0.1%	0.2
50000					0.8%	1.0	0.0%	0.0

13. NIGHTCAP AT MISTY MOUNTAIN - TRAFFIC STUDY

Cardno Eppell Olsen - 2006

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**Nightcap at Misty
Mountain –Traffic
Study**

*Prepared for
Nightcap Village*

June 2006

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EXECUTIVE SUMMARY

This traffic report documents the traffic impacts of a master planned village community proposed near Kunghur, 10km west of Uki. It is the intention that the village will support a peak population of approximately 2,000 people (residents and visitors). The village is to accommodate 800 – 1,000 residents and will include the following uses (note that the quantum/size of facilities is indicative at this stage):

- 210 detached residential dwellings;
- 90 residential units;
- 120 townhouses;
- 700sq.m light industrial workshops;
- 1,000sq.m retail area including restaurants/cafes;
- 1,500sq.m conference centre;
- hotel with 100 guest capacity;
- backpacker hostel with 100 guest capacity;
- health/recreation facilities.

The development proposes access to the Kyogle Road via two unsignalised intersections (one existing opposite Mebbin Springs and one new junction 150 – 200m east of here). The traffic analysis indicates that both junctions will operate acceptably with full development traffic beyond a 2027 horizon.

Whilst the assessment considers an unsignalised T junction at the western site access (opposite the Mebbin Springs access) it is recommended that a more desirable form would be a roundabout at this location on Kyogle Road. The roundabout would incorporate this western access plus the Mebbin Springs access. The advantage of the roundabout is that it would:

- accommodate turning traffic to both the subject site and Mebbin Springs;
- signify the existence of the village on this section of Kyogle Road;
- reduce traffic speed on Kyogle Road adjacent to and approaching the village site.

Given the form of Kyogle Road approaching the site from both the east and west and the proposed development of the village, it is recommended that a slower speed limit be incorporated on Kyogle Road. This speed limit is recommended at 80km/h on the approaches towards the village (e.g. 1-2km in either direction) and as low as 60km/h directly adjacent to the village (on Kyogle Road). The recommended roundabout would support this reduced speed limit.

The development will introduce approximately 4,500vpd onto the adjacent road system (Kyogle Road) which currently carries approximately 1,200vpd near the site.

Nightcap at Misty Mountain –Traffic Study

An assessment has been made of the traffic aspects of the development using the following Tweed Shire Council codes and policies:

- Development and Control Plan No. 2 – Site Access and Parking Code (1999 version);
- Development and Control Plan No. 6 – Multi-Dwelling Housing (2001 version);
- Development and Control Plan No. 16 – Subdivision Manual (2003 version);
- Tweed Road Contribution Plan CP no. 4, Version 4.8 (TRCP).

The initial application is to subdivide the site into three 'management' lots. Subsequent stages will involve the development of the various land uses within strata title schemes within each of these management lots. Using the Tweed Road Contribution Plan (TRCP) the approximate contribution to external transport infrastructure by the subject application (ie. three management lots) will be \$32,474.93 (4.5vpd per household x 3 lots x \$2,405.55). At the time of any subsequent applications for each of the development stages, TRCP payments will be necessary recognising that there may be credits applicable to cover the cost of provision (by the developer) of the local street network within the development site. This mechanism will ensure that significant contributions to the TRCP are made as each development stage is approved.

The village site is proposed to comprise a number of strata title schemes within each of the management lots. To encourage the village atmosphere, parking and traffic within the village centre is to be discouraged. The parking provision on site is to be a combination of public parking areas (communal), public on street parking and private off street parking. The aim is to encourage visitors to park in the public (communal) areas and walk to and within the village.

Nightcap at Misty Mountain –Traffic Study

Whilst the individual parking requirements will be finalised as part of each application, the intent is to ensure that the overall quantum satisfies the public demand and Council's planning requirements. To this end, we believe the appropriate minimum provision to satisfy the development mix/quantum assumed herein is as follows:

- 235 public car spaces (see below);
- 1 space on site for each residential lot;
- 1 space on site for each residential unit;
- 1 space on site for each townhouse;
- 50 guest spaces on site for the hotel (see below);
- 50 guest spaces on site for the convention centre (see below);
- 20 guest spaces on site for the backpackers.

Given the cross usage of facilities on site it is suggested that the hotel and convention centre parking could be reduced by up to 50%. Similarly, the public (communal) car parking of 235 spaces could be reduced by up to 20%.

The street network within the site will comprise a number of public roadways providing connection between Kyogle Road and the management lots (as part of the initial application). With development of the strata title schemes in subsequent stages, a number of private roadways will be developed. Some additional public roadways may also be required in these subsequent stages. Within the village site the speed limit is intended to be no greater than 40km/h.

As part of the initial application for the management lots the following road cross sections are proposed in accordance with Council's standards for road design:

- neighbourhood connector street – 11m wide pavement (maximum) within an 18m wide road reserve – to connect from each access point on Kyogle Road to the central village connector street;
- central village connector street – 9m wide pavement (maximum) within a 17m wide road reserve – the east west connector street through the village centre connecting between each of the neighbourhood connector streets;
- access street – 7.5m wide pavement (maximum) within a 14.5m wide road reserve – to connect from the central village connector street beyond the western boundary of the site.

Nightcap at Misty Mountain –Traffic Study

A significant network of pedestrian and bicycle pathways is proposed throughout the entire site. This network provides connections within and between the management lots. The network provides easy pedestrian connections between all proposed sites and the village centre and between the main entry car park (and other car parks) and the village centre. This network is considered appropriate and desirable to meet the non motorised mobility needs of the development and will facilitate the village objective of minimising car usage.

An assessment of the form of intersections on Kyogle Road has indicated that unsignalised T junctions with appropriate turning lanes on Kyogle Road are suitable. Nonetheless, a roundabout is the recommended treatment at the western access intersection (as discussed earlier). Sight distance to/from each access location has been checked and would meet the appropriate criteria subject to some vegetation clearing on the site and within the road reserve

1.0 INTRODUCTION

Cardno Eppell Olsen has been commissioned to undertake a traffic assessment to accompany a master plan application for a proposed village named “Nightcap at Misty Mountain” at a site near Kunghur (near Uki) in the Nightcap Range of Northern New South Wales.

The overall master plan adopted for the proposal is to develop a self-contained sustainable village for approximately 800 – 1,000 residents. It is the intention that the village will support a peak population of approximately 2,000 people (residents and visitors). The site is situated in the Tweed Valley, bounded by the National Parks of Nightcap and Border Ranges and the Tweed River, and is serviced by Kyogle Road along the southern boundary. The nearest township is Uki, approximately 10km east along Kyogle Road.

The objective of this assessment is to evaluate the impact of traffic generated by the village, both internal and external to the village. This includes consideration of appropriate infrastructure contribution, intersection analysis and the required parking spaces.

The assessment has been undertaken with information provided by the applicant and Tweed Shire Council. Relevant Codes and policies have been used from the following:

- Development and Control Plan No. 2 – Site Access and Parking Code (1999 version);
- Development and Control Plan No. 6 – Multi-Dwelling Housing (2001 version);
- Development and Control Plan No. 16 – Subdivision Manual (2003 version);
- Tweed Road Contribution Plan CP no. 4, Version 4.8 (TRCP).

The broad methodology for the assessment has been to identify the likely traffic generation for the development components and assess the required road network form. The subject application is to subdivide the site into three ‘management’ lots. In this regard the appropriate financial contribution to road infrastructure (under the TRCP) has been identified.

Parking requirements are calculated for the overall development according to the Tweed Shire Council ‘Site Access and Parking Code, 1999’. However, as discussed within the reports, the parking provisions for the overall site will represent a mixture of individual site parking and communal (or village) parking.

2.0 PROPOSED DEVELOPMENT

The development application is for a Concept Proposal and Integrated Development comprising residential housing, commercial units, recreation and conference/teaching facilities. The initial application is to reconfigure the site to create three 'management' lots. Subsequent to this the proposed master plan will be developed in a series of strata title schemes. Whilst the master plan is flexible in its detail, the current proposal intends to construct the following:

- 210 detached residential dwellings;
- 90 residential units;
- 120 townhouses;
- 700sq.m light industrial workshops;
- 1,000sq.m retail area including restaurants/cafes;
- 1,500sq.m conference centre;
- hotel with 100 guest capacity
- backpacker hostel with 100 guest capacity
- health/recreation facilities

The village development layout is shown on the master plan at Appendix A.

The proposed vehicular and traffic arrangements for the development are relatively unique and have been developed by the planning team to maximise the "village" atmosphere within the development. The proposal is for the majority of non essential and non residential traffic to park at the front of the development site and walk into the village. This is to occur via a main car park adjacent to Kyogle Road with pedestrian connection (bridge and pathways) between the car park and the village.

The objective of this design philosophy is to minimise vehicular traffic within the village and enhance the streetscape for pedestrian use.

In line with this design/planning objective most parts of the village development will be strata titled. In these areas, all roads will be owned and managed by the body corporate. A number of public owned roads are proposed to connect the three management lots to Kyogle Road.

2.1 Proposed Access

Two entrances are proposed on Kyogle Road to access the village (see Appendix B).

The main access (referred herein as Access A or Western Access) is via the existing unsignalised T-junction on Kyogle Road approximately 50m west of the existing access to Mebbin Springs (on the southern side of Kyogle Road). This is shown by the concept drawing number 8413 – 104 at Appendix B. Whilst the unsignalised form can provide satisfactory capacity and operation, a four leg roundabout on Kyogle Road at this location opposite the existing access to Mebbin Springs is considered to be more appropriate and desirable solution. The roundabout concept will incorporate the access to Mebbin Springs (see concept drawing number 8413 – 105 at Appendix B). This concept is discussed further in Section 5.0.

The master plan concept incorporates a car park immediately south of the Tweed River and adjacent to this western entrance to enable visitors to park and use a path and walking bridge to access the village centre.

The second access (referred herein as Access B or Eastern Access) will be constructed 150 - 200m east of the main entrance, and will provide a more direct access to the residential areas of the village (on the northern side of the site) from Kyogle Road. This intersection will be in the form of an unsignalised T-junction.

3.0 EXISTING SITUATION

The site of the proposed village is currently vacant land. Under the Tweed Shire Environmental Plan, the site is designated as 'village'.

A rural residential development, named Mebbin Springs, of approximately 60 lots has recently been developed across the road from the proposed main entrance. This recent development is complete but no dwellings have been constructed as yet.

The current access to the village site is via an existing public roadway with an unsignalised intersection on Kyogle Road opposite Mebbin Springs and approximately 50m west of the Mebbin Springs access. This existing public roadway (unsealed) winds west and approximately 200m west of the Kyogle Road intersection a private road traverses north to the site via a bridge over the Tweed River. The existing unsealed public roadway heads west from the site to some minor rural properties and a few school camping sites.

Kyogle Road is an undivided two lane arterial road owned by the Roads and Traffic Authority (RTA). Whilst it is owned by RTA, it is considered to be a secondary road hence the roadway is within the jurisdiction/responsibility of the Tweed Shire Council. It connects the towns of Kyogle approximately 40km west of the site and Murwillumbah 20 km to the east. It passes through a number of villages and towns along the route, including Uki and Kunghur. The speed limit on Kyogle Road is unposted other than the 'open speed limit' sign. The typical speed is likely to be 80 – 100km/h on Kyogle Road adjacent to the site.

The existing intersection layout as shared by the two development sites (subject site and Mebbin Springs) is staggered and accommodates right turning lanes to each development. The current siting provides for adequate site distances in both the east and west directions.

Traffic count data for Kyogle Road in the vicinity of the area has been obtained from Tweed Shire Council. An August 2004 survey indicates a daily traffic volume of 1,214 veh/day.

4.0 DEVELOPMENT TRAFFIC GENERATION

For the assessment of the traffic generation impacts, conservatively high volumes have been assumed to ensure that any capacity deficiencies in the road network are identified. It is noted that in Section 6.0 the appropriate infrastructure contribution under the Tweed Road Contribution Plan (TRCP) is calculated based on the subject application to create three management lots.

4.1 Source of Rates

Queensland Transport's Draft Transport Assessment Guide (as documented in the Queensland Department of Main Roads' Road Planning and Design Manual) and RTA's Guide To Traffic Generating Developments are the sources of the base traffic generation rates used in this assessment. The base rates (peak hour and daily) are reported in Table 4.1.

Table 4.1

Traffic Generation Rates

Land Use	Peak Hour Vehicle Trips	Daily Vehicle Trips
Residential – Lots	0.8/dwelling	8/dwelling
Residential - Units – Medium / Mixed	0.6/dwelling	6/dwelling
Residential - Units – Townhouses	0.6/dwelling	6/dwelling
Commercial – Hotel	0.4/room	4/room
Mixed Use – Workshops (1)	2/100sq.m	10/100sq.m
Mixed Use – Retail (2)	AM 3.69/100sq.m PM 12.3/100sq.m	123/100sq.m
Mixed Use – Convention Centre (3)	5/100sq.m	60/100sq.m
Mixed Use - Backpackers	0.2/bed	2/bed
Health Space	9/100sq.m	45/100sq.m
Green Space (Village Green) (4)	10/number	100
Green Space (Sports Display) (4)	10/number	100
Green Space (Market Garden) (4)	10/number	100
Car Park (5)	2/car space	20
Existing Road to Mount Warning – Camping Ground (4)	5/number	50
Existing Old Road (4)	5/number	50

Notes (for Table 4.1):

(1) based on commercial use traffic generation rates

(2) AM peak traffic generation assumed to be 30% of PM peak traffic generation

(3) based on restaurant traffic generation rates

(4) represents a nominal assumption only

(5) generation is not calculated using this rate since the generation is based on the other uses within the table

4.2 Assumptions on Rates and Distributions

A number of assumptions on traffic generation and distribution have been applied (see Table A at Appendix C for details). An internal trip generation factor provided in Table A is to remove the wholly internal traffic from the traffic volumes generated at the intersections with Kyogle Road. Similarly, allowance is made for shared purpose journeys (ie. a cross use reduction factor has been applied where trips generated by one use represent a shared use trip generated by another use).

For the purpose of intersection analysis the traffic has been assigned to the two village entrances as follows (see Table B at Appendix C for details):

- 60% via the eastern access (Access B);
- 40% via the western access (Access A);
- 70% of all traffic will head east on Kyogle Road;
- 30% of all traffic will head west on Kyogle Road.

4.3 Generated Traffic Volumes

Using the information presented in Section 3.0 and the assumptions documented in the previous sections the resultant traffic volumes at the Kyogle Road intersections are detailed in Tables 4.2 (western access as T junction), 4.3 (western access as roundabout) and 4.4 (eastern access as T Junction).

The Tables 4.2, 4.3 and 4.4 following provide a listing of traffic volumes at both intersections for the following scenarios (see worksheets at Appendix C):

- | | |
|---|--|
| A | 2006 Base Traffic – without development (AM Peak); |
| B | 2006 Base Traffic – without development (PM Peak); |
| C | 2007 Base Traffic using a 3% yearly growth rate – without development traffic (AM Peak); |
| D | 2007 Base Traffic using a 3% yearly growth rate – without development traffic (PM Peak); |
| E | 2017 Base Traffic using a 3% yearly growth rate – without development traffic (AM Peak); |
| F | 2017 Base Traffic using a 3% yearly growth rate – without development traffic (PM Peak); |
| G | 2027 Base Traffic using a 3% yearly growth rate – without development traffic (AM Peak); |
| H | 2027 Base Traffic using a 3% yearly growth rate – without development traffic (PM Peak); |

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- I Development Traffic (AM Peak);
- J Development Traffic (PM Peak);
- K 2017 Base Traffic using a 3% yearly growth rate – with development traffic (AM Peak);
- L 2017 Base Traffic using a 3% yearly growth rate – with development traffic (PM Peak);
- M 2027 Base Traffic using a 3% yearly growth rate – with development traffic (AM Peak);
- N 2027 Base Traffic using a 3% yearly growth rate – with development traffic (PM Peak).

Note that for the existing public roadway at Access A (the western access) an existing base traffic of 100vpd has been assumed. The 2027 horizon has been adopted as a ten year planning horizon from an arbitrary completion date of 2017. This is considered reasonable for planning and assessment purposes.

The Kyogle Road / Access A junction currently exists as a T junction (unsignalised) and has been assessed in this existing form. It is noted that a more desirable solution is that the intersection to be constructed as a four leg roundabout incorporating the access road to Mebbin Springs. This roundabout option has also been assessed as a single lane roundabout.

The Kyogle Road / Access B junction does not currently exist. This junction is proposed as an unsignalised T junction with auxiliary turning lanes on Kyogle Road. It is assumed that this intersection will be in full operation at the completion of the development proposed for 2017.

Table 4.2 *Kyogle Road / Access Road A (Western) T Junction*

Direction of Traffic		L	T	R	T	L	R
Approach		From Kyogle Road West		From Kyogle Road East		From Access Road A	
A	Vehicles	2	95	1	41	5	2
B	Vehicles	2	41	4	95	3	1
C	Vehicles	2	98	1	42	5	2
D	Vehicles	2	42	4	98	3	1
E	Vehicles	3	127	1	55	7	3
F	Vehicles	3	55	5	127	4	1
G	Vehicles	4	165	1	72	9	4
H	Vehicles	4	72	7	165	5	1
I	Vehicles	45	68	19	43	67	29
J	Vehicles	27	41	64	41	63	27
K	Vehicles	48	195	20	98	74	32
L	Vehicles	30	96	69	168	67	28
M	Vehicles	49	233	20	115	76	33
N	Vehicles	31	113	71	206	68	28

Table 4.3 Kyogle Road / Mebbin Springs / Access Road A (Western) Roundabout

Direction of Traffic		L	T	R	L	T	R	L	T	R	L	T	R
Approach		From Kyogle Road West			From Kyogle Road East			From Access Road A			From Mebbin Springs Access		
A	Vehicles	2	95	2	1	41	1	5	1	2	2	1	4
B	Vehicles	2	41	2	3	95	4	3	1	1	1	1	2
C	Vehicles	2	98	2	1	42	1	5	1	2	2	1	4
D	Vehicles	2	42	2	3	98	4	3	1	1	1	1	2
E	Vehicles	3	127	3	1	55	1	7	1	3	3	1	5
F	Vehicles	3	55	3	4	127	5	4	1	1	1	1	3
G	Vehicles	4	165	4	1	72	1	9	1	4	4	1	7
H	Vehicles	4	72	4	5	165	7	5	1	1	1	1	4
I	Vehicles	45	68	N/A	N/A	43	19	67	N/A	29	N/A	N/A	N/A
J	Vehicles	27	41	N/A	N/A	41	64	63	N/A	27	N/A	N/A	N/A
K	Vehicles	48	195	3	1	98	20	74	1	32	3	1	5
L	Vehicles	30	96	3	4	168	69	67	1	28	1	1	3
M	Vehicles	49	233	4	1	115	20	76	1	33	4	1	7
N	Vehicles	31	113	4	5	206	71	68	1	28	1	1	4

Table 4.4 Kyogle Road / Access Road B (Eastern) T Junction

Direction of Traffic		L	T	R	T	L	R
Approach		From Kyogle Road West		From Kyogle Road East		From Access Road B	
A	Vehicles	N/A	100	N/A	42	N/A	N/A
B	Vehicles	N/A	44	N/A	99	N/A	N/A
C	Vehicles	N/A	103	N/A	43	N/A	N/A
D	Vehicles	N/A	45	N/A	102	N/A	N/A
E	Vehicles	N/A	131	N/A	55	N/A	N/A
F	Vehicles	N/A	57	N/A	130	N/A	N/A
G	Vehicles	N/A	170	N/A	72	N/A	N/A
H	Vehicles	N/A	75	N/A	169	N/A	N/A
I	Vehicles	68	67	29	19	100	43
J	Vehicles	41	63	96	64	95	41
K	Vehicles	68	198	29	74	100	44
L	Vehicles	41	120	96	194	95	42
M	Vehicles	68	237	29	91	100	44
N	Vehicles	41	138	96	233	95	42

5.0 ROAD NETWORK ASSESSMENT

Assessment of the village road network and its impacts on Kyogle Road intersections comprises the peak hour intersection capacity impacts and the daily volumes for both capacity and amenity. For the purpose of the assessment a traffic assignment spreadsheet has been developed. This spreadsheet incorporates the entire village development in order to identify ultimate traffic volumes generated internally and at the intersections on Kyogle Road.

Kyogle Road traffic counts have been projected to a future horizon (twenty years) to 2027 by adopting a 3% per annum linear growth rate. This is additional to the development generated traffic.

Traffic volumes within the village have been derived in the spreadsheet using generation and distribution assumptions discussed in Section 4.0. This includes all proposed village development, residential, commercial, recreational and conference facilities.

It is assumed that the proposed village will be fully developed once the current proposal is complete; hence no traffic growth rate has been applied to traffic internally generated. It has also been assumed that the development will commence in 2007 and will be staged over a 10 year period (i.e. assumed completion by 2017).

5.1 Site Access

The adopted design for access to the village from Kyogle Road is to provide a main entrance (Access A) via the existing unsignalised T junction on Kyogle Road adjacent to the Mebbin Springs access road (see drawing 8413 – 104 at Appendix B) and a second access (Access B - a T-junction with a right turn bay into the site), 150 - 200m east of the current entrance with an additional river crossing. The main access will utilise the existing river crossing into the site. The main justification for the two access points is to:

- separate the two traffic streams, residential and visitors;
- provide the residential areas with a more direct route to/from Kyogle Road. This will provide greater convenience and more efficient emergency access in case of bush fire;
- provide a temporary and separate construction access as each stage of the development is completed.

The recommended alternative form for the main access (Access A) is a roundabout on Kyogle Road (see drawing 8413 – 105 at Appendix B). The objective of this intersection form is to accommodate the potential four way (or offset T junction) with Mebbin Springs and to also create a relatively slow speed environment on Kyogle Road adjacent to the proposed village. The latter is considered to be a vital part of the village atmosphere and has a similar objective to the slow speed areas through adjacent villages (eg. Uki). The proposed large roundabout can achieve the appropriate speed reduction without significant impediment to through traffic on Kyogle Road. This concept has been discussed with officers of Tweed Shire Council and they are generally supportive of this notion.

The second access (Access B) will be an unsignalised T-junction with a right turning lane for traffic from Kyogle Road.

5.2 Intersection Capacity Analysis

The peak hour intersection capacity analysis has been undertaken using the aaSIDRA computer package. Analysis of the two intersections on Kyogle Road has been undertaken in order to understand the impact of the proposed development. Both intersections have been analysed in their current and proposed configuration with development traffic using the aaSIDRA computer program.

For unsignalised intersections, the maximum desirable Degree of Saturation (DOS) is 0.80 as suggested by AUSTROADS. Similarly, a maximum degree of saturation of 0.85 is adopted for a roundabout. A degree of saturation of 1.0 indicates that the intersection has reached it's maximum theoretical capacity, and there would be limitations on the operation of the intersection. The maximum degree of saturation for the two intersections with development traffic is reported in Table 5.1 below.

Table 5.1 *Intersection Analysis Results with Proposed Layout*

Intersection	DOS (2027 Peak Hour with Development)	
	AM	PM
Kyogle Road / Access Road A (T Junction)	0.16	0.12
Kyogle Road / Mebbin Springs / Access Road A (Roundabout)	0.20	0.20
Kyogle Road / Access Road B (T Junction)	0.18	0.13

In 2027 with the proposed developments, the two intersections will operate with adequate capacity in the current and proposed configurations, during both the AM and PM peaks.

The analysis results indicate that all intersection configurations have a degree of saturation less than the desirable maximum of 0.80 or 0.85 for the respective type of intersection. As such, adequate capacity is achievable.

5.3 Daily traffic Volumes

Using the traffic volume spreadsheets the total daily volume generated by the development at the access points is as follows:

- Access A (Western Access) - two way daily total = 1,802vpd;
- Access B (Eastern Access) – two way daily total = 2,704vpd.

It is recognised that these totals do not include some of the trips generated internally within the site. Nonetheless, it is concluded that all roadways within the site are expected to have a daily volume of less than 3,000vpd. The latter is accepted as the maximum volume tolerable for reasonable amenity on a residential street. As such, the daily volumes are considered acceptable.

5.4 Intersection Sight Distance

An assessment has been undertaken of the sight distance requirement at each of the two proposed access intersections on Kyogle Road. The speed limit on Kyogle Road is not posted other than an open speed limit sign. Based on a design speed of 100km/h, the following minimum sight distance is required to satisfy Austroads 'Guide to Traffic Engineering Practice, Part 5, Intersections at Grade':

- approach sight distance (ASD) from Kyogle Road to the access – minimum 157m, desirable 170m;
- safe intersection sight distance (SISD) from access point to Kyogle Road – minimum 240m, desirable 253m.

At the western access intersection (i.e. the existing intersection opposite Mebbin Springs) the ASD is greater than 200m from both directions. The SISD from this intersection to the east is greater than 250m and to the west is approximately 200m. With some vegetation clearing in the road reserve, the latter sight distance would be greater than 300m. Note that with construction of the recommended roundabout these sight distance criteria become irrelevant and a new set of criteria will be necessary for the roundabout. Whilst such criteria will be assessed at the time of further design of the roundabout, we are confident that there will be no limitations to achieving satisfactory sight distance.

Nightcap at Misty Mountain – Traffic Study

At the eastern access intersection (as proposed) the ASD is greater than 200m from the west and is approximately 100m from the east. The latter can easily be increased to 200m with clearing of some vegetation on the subject site and road reserve. The SISD to the west is currently greater than 400m and to the east is approximately 100m. With vegetation clearing on the subject site and road reserve the latter could be greater than 250m.

Based on these field measurements, it is concluded that safe sight distances are achievable with the proposed intersection locations.

Note that the sight distance assessment is based on a 100km/h speed limit. Given the 'village' designation of the subject site, it is anticipated that the speed limit on Kyogle Road would be reduced to 80km/h (at least) or possibly 60km/h adjacent to the site. Accordingly, the minimum sight distance criteria would be reduced.

Given the recommended roundabout at Access A, and the village designation of the site, it is suggested that the speed limit on Kyogle Road should be reduced to:

- 60km/h through the roundabout and the Access B junction – both junctions should be designed with a design speed of 80km/h given the prevailing speeds;
- 80km/h prior to and after the two site access intersections – approximately 1-2km away from each junction;
- retention of the existing open speed limit (or 100km/h) beyond the 80km/h limit.

Given the function of Kyogle Road and the proposed function of the two access intersections, it is suggested that the proposed eastern junction on Kyogle Road (Access B) should include dedicated turning lanes (left and right) from Kyogle Road into the site. The latter would reduce the disruption to through traffic (on Kyogle Road) caused by turning traffic (to the site).

6.0 COST CONTRIBUTION

6.1 TRCP Calculation

The Tweed Shire Council has developed the Tweed Road Contribution Plan CP No. 4, Version 4.8 (TRCP) whereby each new development pays a financial contribution according to the amount of traffic generated by the development. The contribution is required to enable the local authority to fund the construction of road infrastructure to which all developments contribute. The contributions and works are directed towards the external road network and impacts, not the internal road network that would be provided by the applicant or developer in each case.

The daily trip rates used to calculate the cost contribution are as detailed in Council's Tweed Road Contribution Plan. It must be recognised that the subject application is only to create three management lots (at this time) hence the initial TRCP is based only on three lots. At the time of the subsequent applications for each of the master plan components, the TRCP for that component will be determined. The latter calculations will take consideration of the following:

- reduced trip generation externally due to internal trip attractions and internal trips;
- reduced trip generation due to cross usage of facilities on site;
- appropriate credits to the applicant as a result of the applicant constructing public roadways within the site.

Under the TRCP, the contribution rate applicable for this area (Sector 13) is \$2,405.55 per vehicle per day (vpd). This amount is based on the following information and calculation formula:

- standard trip end cost = \$2,232 per vpd;
- interest trip end cost = \$59 per vpd;
- administration factor = 1.05;
- Total Trip End Cost = \$2,405.55 per vehicle per day (vpd).

The TRCP contribution for the subject application (three management lots) is therefore \$32,474.93 (4.5vpd per household x 3 lots x \$2,405.55).

7.0 CAR PARK ASSESSMENT

Parking provisions for the village are to be made by a combination of the following components:

- private parking within selected development sites;
- public off street parking within selected development sites;
- public on street parking within the private street system;
- public off street parking within a number of dedicated car parks throughout the site;
- public off street parking within the dedicated car park between Tweed River and the Kyogle Road.

The objective of the development proposal is to encourage visitors to park in the off street public car parks and walk to and within the village centre, thereby reducing traffic movements in the village.

Details of parking within each of the components of the development will be better defined at each stage of development however the overall provision in total shall meet the Tweed Shire Council parking requirements. These requirements are summarised in Table 7.1 for each of the respective uses (recognising that the master plan is indicative at this stage).

Table 7.1

Car Parking Requirements

Land Use	Floor space/no. of dwellings	Council DCP2 Parking Rate	Parking Space Requirement	Proposed Provision
1. Residential Lots	210 dwellings	1/dwelling plus provision for driveway parking	210	Minimum of 1.0 space to be provided on each individual lot, and on street parking allowed (where achievable) for visitors
2. Residential Units Medium/Mixed	45 units	1.5/dwelling	45 + 23*	Minimum of 1.0 car space per unit to be provided on each unit site with visitor parking provided in adjacent public car parking areas
3. Residential Units Medium/Mixed	23 units	1.5/dwelling	23 + 12*	Minimum of 1.0 car space per unit to be provided on each unit site with visitor parking provided in adjacent public car parking areas

Nightcap at Misty Mountain – Traffic Study

Table cont...

4. Residential - Units - Medium/Mixed	22 units	1.5/dwelling	22 + 11*	Minimum of 1.0 car space per unit to be provided on each unit site with visitor parking provided in adjacent public car parking areas
5. Residential - Townhouses	120 units	1.5/dwelling	120 + 60*	Minimum of 1.0 car space per townhouse to be provided on each site with visitor parking provided in adjacent public car parking areas
6. Commercial - Hotel	50 rooms	0.5/staff plus 1/unit + 1/15sq.m GFA restaurant open to the public	10* + 50 + 10*	Minimum of 1.0 space per room provided on site, staff (assume 20 staff) and restaurant (assume 150sq.m) parking provided in public parking areas
7. Mixed Use - Workshops	700sq.m GFA	1/40sq.m for staff + 1/100sq.m	18* + 7*	All parking to be provided in public car parking areas
8. Mixed Use - Retail	1000sq.m GFA	0.5/100sq.m GFA staff plus 3.5/100sq.m GFA customer	5* + 35*	All parking to be provided in public car parking areas
9a. Mixed Use - Convention Centre	1,500sq.m GFA	0.5/staff plus 1/3 seats or 1/7m2 dining area	10* + 50	Guest parking (assume 150 seats) provided on site, staff parking (assume 20 staff) provided in public parking areas
9b. Mixed Use - Backpackers	100 beds	0.5/staff plus 1/5 beds or 1/10 beds if shuttle bus permanently utilised	5* + 20	Guest parking (assume 100 beds) provided on site, staff parking (assume 10 staff) provided in public parking areas
10. Health Space	400m2 GFA	0.5/staff plus 6/100m2 GFA customer	5* + 24*	All parking to be provided in public car parking areas
TOTAL			235*	* parking provided in public car parking areas

Nightcap at Misty Mountain –Traffic Study

The Council parking requirements and the proposed arrangements for public/private and on/off street parking (as outlined in Table 7.1) are such that a minimum total of 235 public car parking spaces are required on site (see discussion below), in addition to the identified requirements for on site parking at the following facilities:

- residential lots – 1 space per lot;
- residential units – 1 space per unit;
- townhouses – 1 space per unit;
- hotel – 50 guest spaces;
- convention centre – 50 guest spaces (see note below);
- backpackers – 20 guest spaces.

Given the anticipated cross usage between the hotel and the convention centre, a relaxation in the number of guest spaces provided at the convention centre is considered appropriate. A relaxation of up to 50% would not be unreasonable.

Of the requirement projected for 235 public car spaces it is recognised that there will be some cross usage between many of the non-residential facilities. Such cross usage would result in a lesser demand and a relaxation of up to 20% of these total spaces is considered reasonable. Note that Council's "DCP No. 2 – Site Access and Parking Code" suggests that such relaxation could be as high as 30% for customer car parking.

Based on the indicative site planning it is anticipated that the site can yield approximately 200 public off street car spaces and would therefore satisfy the Council requirements.

Note that service vehicle parking requirements are expected to be met by dedicated bays on specific sites (i.e. hotel, convention centre, backpackers, health space) and by on street provisions within the private street network (for retail, mixed use).

8.0 ROAD AND PATHWAY NETWORK

8.1 Road Cross Sections

The Tweed Shire Council DCP 16 has been used as the basis for developing the proposed cross sections for the public roadways within the development site. Note that a number of private roadways will also be developed as part of each master plan component but this will be the subject of future applications. For the subject application (ie. the three management lots) the following road cross sections are proposed in accordance with Council's standards for road design:

- neighbourhood connector streets – 11m wide pavement (maximum) within an 18m wide road reserve – to connect from each access point on Kyogle Road to the central village connector street;
- central village connector street – 9m wide pavement (maximum) within a 17m wide road reserve – the east west connector street through the village centre connecting between each of the neighbourhood connector streets;
- access street – 7.5m wide pavement (maximum) within a 14.5m wide road reserve – to connect from the central village connector street beyond the western boundary of the site.

Note that the above street widths are proposed as the maximum street widths. In many cases a lesser width will be proposed where no kerbside parking is required. The lesser street width is a key component of the village atmosphere where the road reserve is to be predominantly used for pedestrian/cyclist and open space or outdoor dining/use areas. The Council road reserve widths are to be retained in these areas and the verge/footpath width increased in those locations where the road pavement width is reduced.

For the neighbourhood connector streets and the central village connector street, the proposed road form is to accommodate a bus route (future provision). Within the village site the speed limit on all roadways is intended to be no greater than 40km/h.

8.2 Pedestrian/Cyclist Pathways

A significant network of pedestrian and bicycle pathways is proposed throughout the entire site. This network provides connections within and between the management lots. The network provides easy pedestrian connections between all proposed sites and the village centre and between the main entry car park (and other car parks) and the village centre. This network is considered appropriate and desirable to meet the non motorised mobility needs of the development and will facilitate the village objective of minimising car usage.

Appendix A

Master Plan of Development



CONCEPT PLAN A

Appendix B

Proposed Access Concept

CONCEPT ONLY



Cardno
Eppell Olsen
BRISBANE OFFICE
240 Riverside Drive
P.O. Box 3679
South Brisbane Q 4101
Telephone : (07) 3344 3000
Facsimile : (07) 3344 3611
Internet : www.co.com.au Email : info@co.com.au

Issue	Description	Date	By
A	ISSUE FOR COMMENT	1.03.06	J.M.
B	INTRODUCE SOM CREEK BUFFER ON CARPARK	11.04.06	J.M.

PRELIMINARY PRINT
NOT FOR CONSTRUCTION

10 0 10 20 30 40 50 60 70 80 METRES
SCALE 1 : 750 SHEET SIZE A1



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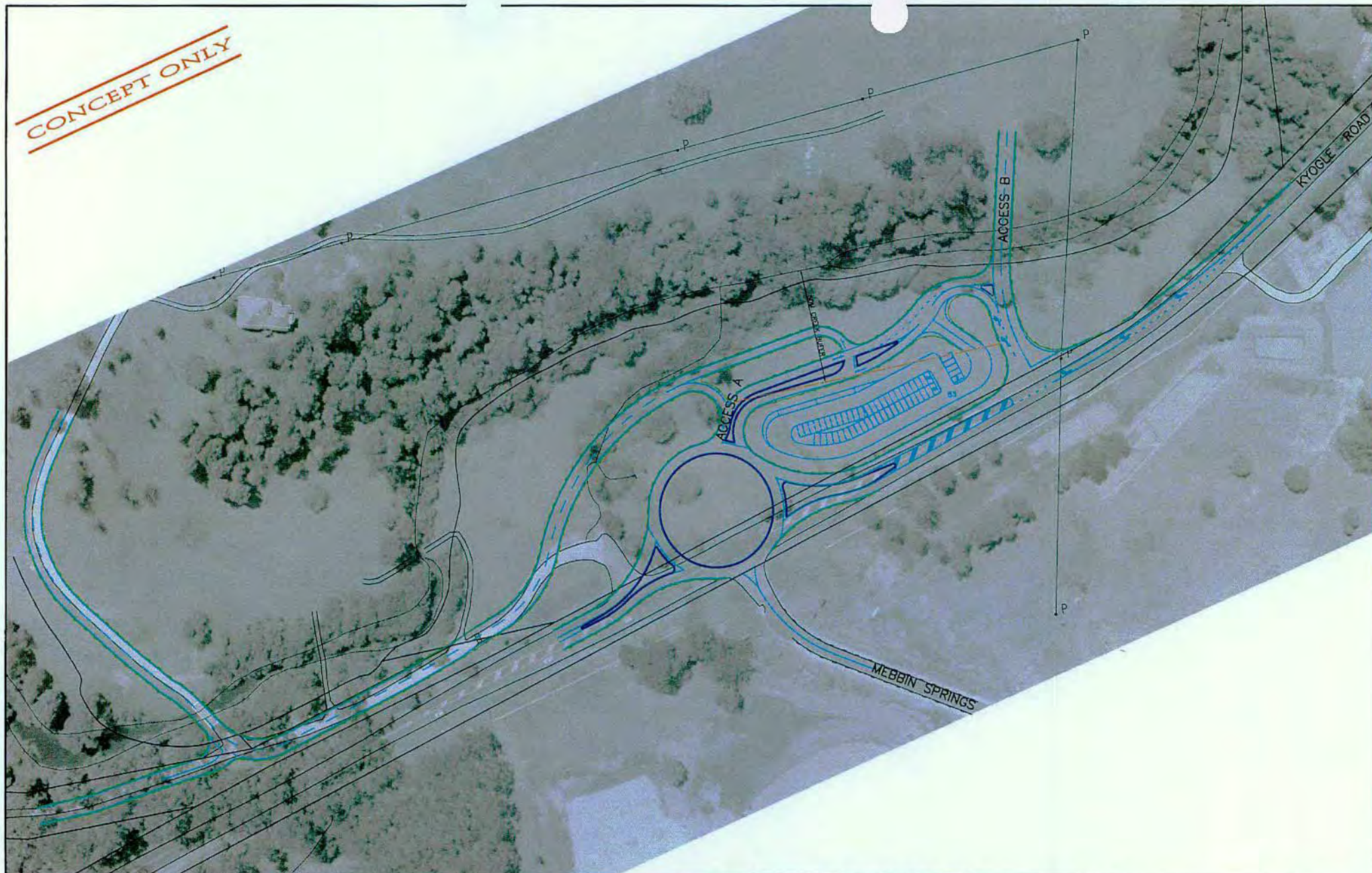
Basic Information Supplied by B & P SURVEYS		
Design J.M.	Drawn J.M.	Checked B.M.
Certified		
RPEQ No.		

Project Title
KUNGHUR VILLAGE
MASTER PLAN
Client
NIGHTCAP VILLAGE

Drawing Title
ROAD LAYOUT
CONCEPT
OPTION 3

Drawing No. 8413-104	
Sheet 1 of 1	Issue B
Scale AS SHOWN	
Project 8413	
Drawn NIL	
ACAD file 8413_Base.dwg	

CONCEPT ONLY



BRISBANE OFFICE
243 Riverside Drive
P.O. Box 10073
South Brisbane Q 4101
Telephone: (07) 3446 2000
Facsimile: (07) 3446 3611
Internet: www.co.com.au Email: eppell@co.com.au

GOLD COAST OFFICE
Suite 2, 20 Herring Street
P.O. Box 961
Nerang Q 4211
Telephone: (07) 5503 1888
Facsimile: (07) 5503 1888

Issue	Description	Date	By
A	ISSUE FOR COMMENT	1.03.08	J.M.
B	CARPARK RELOCATED	3.05.08	J.M.

**PRELIMINARY PRINT
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Base Information Supplied By B & P SURVEYS		
Design J.M.	Drawn J.M.	Checked B.M.
Certified		
RPEQ No.		

Project Title
KUNGHUR VILLAGE MASTER PLAN
Client
NIGHTCAP VILLAGE

Drawing Title	Drawing No.
ROAD LAYOUT CONCEPT OPTION 4	8413-105
	Sheet 1 of 1 Issue
	Scale AS SHOWN B
	Project 8413
	Xref NIL
	ACAD file 8413_Base.dwg

Appendix C

Traffic Volume Spreadsheets

Kunghur Village - TRCP Traffic Generation Rates

Table C

Lot Use	Size	Unit	Modification factor (TRCP Table 7.2)*	Cross use reduction	Internal use reduction	Generation Rate TRCP Table 7.1 (vpd)	daily traffic volume (vpd)	contribution rate (\$/vpd)	Total Contribution (\$)
1. Residential - Lots (100%)	210	dwelling	1.00	0%	20%	6.5	1092	\$2,406	\$2,626,861
2. Residential - Units - Medium / Mixed (50%)	45	dwelling	1.00	0%	20%	3.9	140	\$2,406	\$337,739
3. Residential - Units - Medium / Mixed (25%)	23	dwelling	1.00	0%	20%	3.9	72	\$2,406	\$172,622
4. Residential - Units - Medium / Mixed (25%)	22	dwelling	1.00	0%	20%	3.9	69	\$2,406	\$165,117
5. Residential - Units - Townhouses (100%)	120	dwelling	1.00	0%	20%	3.9	374	\$2,406	\$900,638
6. Commercial - Hotel (100%)	50	rooms	1.00	0%	30%	5	175	\$2,406	\$420,971
7. Mixed Use - Workshops - 50 people employed	700	100m2 GFA	1.00	20%	20%	16	72	\$2,406	\$172,430
8. Mixed Use - Retail	1000	100m2 GFA	1.00	20%	20%	TRCP eqtn**	640	\$2,406	\$1,539,552
9a. Mixed Use - Convention Centre	1500	100m2 GFA	1.00	20%	30%		420	\$2,406	\$1,010,331
9b. Mixed Use - Backpackers	100	beds	1.00	0%	30%		174	\$2,406	\$417,603
10. Health Space	400	100m2 GFA	1.00	20%	20%	50	128	\$2,406	\$307,910
11. Green Space (Village Green)	1	number	1.00	0%	0%	100	-	-	-
12. Green Space (Sports Display)	1	number	1.00	0%	0%	100	-	-	-
13. Green Space (Market Garden)	1	number	1.00	0%	0%	100	-	-	-
14. Car Park	50	car spaces	1.00	100%	0%	20	-	-	-
15. Car Park	50	car spaces	1.00	100%	0%	20	-	-	-
16. Car Park	50	car spaces	1.00	100%	0%	20	-	-	-
17. Car Park	50	car spaces	1.00	100%	0%	20	-	-	-
18. Existing Road to Mount Warning (camping ground)	1	number	1.00	0%	20%	50	-	-	-
19. Existing Old Road	1	number	1.00	0%	20%	50	-	-	-

Total:	3355	\$8,071,775
---------------	-------------	--------------------

* A value of 1.0 is used for no modification

** Retail generation = $200 + 0.8 \times \text{GLA}$

Standard Contribution Calcs

Standard Trip End Cost	\$2,232.00
Interest Trip End Cost	\$59.00
Administration factor	1.05
Total Trip End Cost	\$2,405.55

14. TELECOMMUNICATIONS REGISTRATION

Peter Johnson

From: Registration@telstrasmartcommunity.com
Sent: Thursday, 18 May 2006 9:54 AM
To: pjohnson@cardno.com.au
Subject: Registration Details - Development name: Nightcap 2954 Kyogle Road

Dear Peter Johnson,

Thank you for Registering your Development and submitting your Intent to Develop with Telstra Smart Community.

The details you have provided are attached for your future reference.

This email contains your Registration Number and Password for this development only:-

Registration Number: **12007121**

Password: **kF3bV4**

Your Registration Number and Password must be used for referencing all stages of this development when using the Telstra Smart Community website to view, edit or add further details to your development.

An Application for Reticulation will need to be submitted 3 months prior to the start of each stage of this development. Please use this Registration Number & Password to add your Applications at the appropriate time.

Register your development can be found at:

<http://www.telstrasmartcommunity.com/registerdevelopment.asp>

Following are the details of Telstra's Community Development Consultant for 2954 Kyogle Road .

Name: Mr Joe Pirlo

Address: PO Box 1123, Lismore 2480

Contact Numbers: (w) 02 6626 5250 (m) 0427 231 016 (f) 1800 622 189

Please contact your Community Development Consultant if you have any queries relating to the services that Telstra can provision to your development.

The attachments that were included with the submission can be viewed within the Smart Community developer's administration for this development.

Regards,

Telstra Smart Community Urban Development Team

2.APP.ITD.ACTIVATION.RegistrationDetails

18/05/2006

[Print this page](#)

ITD SubDivision

Name: Nightcap
Location: 2954 Kyogle Road
Suburb: Khungur
Reference:
Approval Number:
Crown Allotment:
Postcode: 2484
Grid:
Map:
Approx Lots: 120
Approx Stages: 6
Works Date: 01/05/2007

ITD Applicant

Role: Consulting Engineer
First name: Peter
Last name: Johnson
Company: Cardno
Phone: 0755399333
Mobile: 0412797685
Address: Commercial Centre Isle of Capri QLD
PostCode: 4217
Email: pjohnson@cardno.com.au

ITD Developer

Role: Developer
First name: Peter
Last name: Johnson
Company: Oaklands Properties Pty Ltd c/o Cardno
Phone: 0755399333
Mobile: 0412797685
Address: Commercial Centre Isle of Capri QLD
PostCode: 4217
Email: pjohnson@cardno.com.au

ITD Consultant

Role: Consulting Engineer
First name: Peter
Last name: Johnson
Company: Cardno
Phone: 0755399333
Mobile: 0412797685
Address: Commercial Centre Isle of Capri QLD
PostCode: 4217
Email: pjohnson@cardno.com.au

ITD Information

Date Created: 09:39:19 18/05/2006
Date Last Modified: 09:54:10 18/05/2006
Developer Consultant: Consulting Engineer
Email Correspondence: no
Send Hard Copy: no
Registered: yes
Completed: yes

ITD Notes

Notes: Development Plans sent to Joe Pirlo - Telstra Lismore

ITD Documents

Document #1: Figure 1 - Locality Plan.pdf

Document #2: Figure 2 - Aerial Photograph.pdf

Document #3: Figure 3 - Overall.pdf

Document #4: Figure 4 - Proposed Plan of Development.pdf

[Print this page](#)

15. NOTICE FOR ELECTRICITY SUPPLY AVAILABILITY

Country Energy - 2006

**NOTICE FOR ELECTRICITY SUPPLY AVAILABILITY TO
PROPOSED NEW SUBDIVISION / ALLOTMENT**

Project Number:

16/06/06

Mr Peter Johnson
Cardno (QLD) Pty Ltd
Commercial Centre
Isle of Capri
Gold Coast QLD 4217

Country EnergyPhone: 02 6643 9446Facsimile: 0266439449Mobile: 0419440585

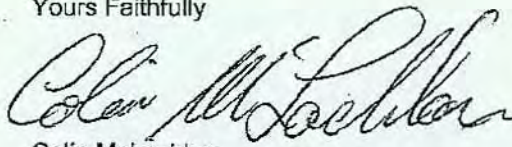
Dear Sir

**RE: NIGHTCAP DEVELOPMENT FOR CARDNO (QLD) Pty Ltd LOT 3 DP 771335 AND LOT 121
134446 KYOGLE ROAD VIA UKI.**

Country Energy wishes to advise that the 11kV network in the vicinity of the above proposed development has capacity to supply the proposed development.

Any extension to or relocation of the network required by the developer will be at the expense of the developer.

Yours Faithfully



Colin McLachlan
Contestable Works Officer – Far North Coast.



**16. NIGHTCAP VILLAGE INTEGRATION OF VILLAGE CONCEPT
WITH THE SURROUNDING LAND**

Biolink Pty Ltd - 2006

Nightcap Village

Integration of village concept with surrounding landuse



March 2006



Biolink Pty Ltd
Ecological Consultants
PO Box 196 UKI NSW 2484
Tel: 02 6672 6966
Fax: 02 6672 6077
www.biolink.com.au

SUMMARY

Rarely does an opportunity present itself to effectively integrate a proposed new village with a change to surrounding landuse such that it has the potential to enhance the proposed community's lifestyle, provide important employment opportunities and generally promote more ecologically sustainable land use practices.

The proposed Nightcap village site, is surrounded by a 1200ha multiple-tenured, land parcel (the balance landholdings), ownership of which is vested in the proponent. Despite a history of disturbance, the balance landholdings retain a number of important conservation values, including large areas of sclerophyll forest and patches of lowland sub-tropical rainforest. A number of threatened flora and fauna species are also known to occur. Current land use activities include plantation forestry, cattle grazing and educational pursuits.

The Nightcap village proposal has the potential to set benchmark standards for ecologically sustainable development practices in the Tweed LGA. In support of this, the balance landholdings also present related opportunities for consideration that, collectively, can only serve to enhance the village and its longer term economic sustainability. Foremost amongst these are opportunities for eco-tourism, a concept enabled by the size of the balance landholdings generally, the proximity of adjoining national park estate and the presence of a large, centrally located precinct known as Central Hill.

The long-term outcome envisaged within this document is for an alternative land use scenario that would see approximately 60-70% of the balance landholdings dedicated to conservation and eco-tourism pursuits, with the remaining 30-40% potentially devoted to plantation forestry. The report concludes by identifying some of the issues arising from such a material change in landuse, while also providing a series of interim recommendations intended to further inform and guide this process in the short to medium term.

Preamble

Ecologically Sustainable Development (ESD) represents one of the greatest challenges facing Australia's governments, industry, business and community. The *National Strategy for Ecologically Sustainable Development* (NSED) provides both strategy and a framework for governments to direct policy and decision making towards long-term benefits (as opposed to short-term gain) in order to ensure inter-generational equity. While there is no universally accepted definition of ESD, in 1990 the Australian Commonwealth Government proposed the following definition:

"using, conserving and enhancing the communities resources so that ecological processes on which life depends are maintained, and the total quality of life, now and in the future, can be increased"

Put simply, ESD is development which aims to meet the needs of Australians today, while conserving ecosystems for the benefit of future generations. To do this, our society needs to develop ways of using those environmental resources which form the basis of our economy in a way which maintains and where possible, improves their range, variety and quality.

Core objectives of the NSED are:

- to enhance individual and community well-being and welfare by following a path of economic development that safeguards the welfare of future generations.
- to provide for equity within and between generations.
- to protect biological diversity and maintain essential ecological processes and life-support systems.

Prepared by the Ecologically Sustainable Development Steering Committee

Endorsed by the Council of Australian Governments

December, 1992

Introduction

This report has been prepared for Peter Van Leishout, the purpose of which is to examine the potential for effective integration of a proposed new village site near Khungur with that of a large area of adjoining 1(a) lands, which for the purposes of this report will generally be referred to as the balance landholdings. The report has been structured so as to (ideally) present a logical sequence of information, concluded by a dot point discussion of the issues that arise, along with a related series of recommendations to facilitate the overall objective of demonstrating the potential benefits associated with a material change in landuse philosophy and activities.

The report has been primarily based on a desk-top review of available information that has been supported by several site inspections, informal discussions with staff of the Dept. of Environment and Conservation, meetings with the landholder and other interested parties. The report has been prepared by Biolink's principal, Dr. Stephen Phillips, who has an extensive background in natural area management.

THE STUDY AREA

1. Location and Planning Context

The study area comprises a multiple-tenured land parcel in single ownership approximately 1300ha in size and located off the Murwillumbah - Kyogle Road approximately 25kms southwest of Murwillumbah. Forty five hectares of land within the study area are currently zoned 2(d) – Village and the remainder 1(a) Rural, for purposes of the *Tweed Local Environmental Plan 2000* (the LEP). Clause 52 (existing and future dam areas) of the LEP further applies to any proposed development within those parts of the study area that occur within the Byrrill Creek catchment. Clause 52 relates to a need to consider the consequences of any proposed development in terms of potential impacts on water quality, the implications of which may necessitate, amongst other things, that a soil and water management plan may need to be prepared. Figure 1 illustrates the planning context of the study area.

2. The Natural Environment

Elevations within the study area range from 70 – 220m ASL, in some areas offering expansive views of Mt. Warning and the surrounding caldera rim. The predominant soil landscapes comprise red and yellow podzols overlaying Bundamba Group sediments (Morand 1996), with some localized alluvial terraces. Vegetation cover ranges from riparian communities along the Tweed River within which Flooded Gum *Eucalyptus grandis*, Weeping Bottle-brush *Callistemon viminalis*, Water Gum *Tristaniopsis laurina* and Silky Oak *Grevillea robusta* are common, to extensive areas of wet and dry sclerophyll forest in more upland areas; these are variously dominated by Brush Box *Lophostemon confertus*, Pink Bloodwood *Corymbia intermedia*, Grey Gum *Eucalyptus propinqua*, Flooded Gum *E. grandis*, Sydney Blue Gum *E. saligna*, White Mahoganies *E. carnea/acmeniodes*, Tallowwood *E. microcorys* and Northern Grey Ironbark *E. siderophloia*. Small patches of lowland sub-tropical rainforest also occur in some drainage lines and alluvial terraces while elsewhere, large expanses of cleared land and areas devoted to plantation forestry are apparent. Figure 2 illustrates the extent of contemporary vegetation cover within the study area.

The natural vegetation remaining within the study area reflects a long history of intensive and unsustainable logging practices. Despite this, the balance landholdings retain a number of important ecological attributes, notably the relatively large areas of sclerophyll forest, and small patches of lowland subtropical rainforest. Because of the logging history, there is a dearth of old growth (hollow-bearing) trees on the site and their absence/low density will be a limiting factor in longer-term recovery of biodiversity values. From this perspective, earlier survey work by Gilmore and Milledge (1984) recorded a depauperate yet diverse flora and fauna on the site, the extent of which no doubt reflects both the history of past disturbance(s) and the proximity of other large areas of forest, including what is now Mebbin National Park. Notable amongst the 141 vertebrate species recorded by Gilmore and Milledge (1984) are a number of threatened species (see below), in addition to some unusual and/or uncommonly sighted species such as Fletcher's Frog *Lechriodus fletcheri*, Logrunners *Ortonyx temminckii*, Paradise Riflebirds *Ptilioris*

paradiseus, Feather-tailed Gliders *Acrobates pygmaeus* and Greater Gliders *Petauroides volans*

As alluded to above, a number of flora/fauna species and ecological communities of interest occur within the boundaries of the balance landholdings. However, it must be reiterated that there has been no formal survey work undertaken in the study area since the work of Gilmore and Milledge (1984), thus the number of threatened species known to be utilizing habitat within the balance landholdings can reasonably be expected to increase with further survey effort.

Flora/fauna species and ecological communities of particular interest within the balance landholdings include the following:

Flora

i) ROTAP Species (Briggs and Leigh 1995)

Black Walnut^{1,4} *Endiandra globosa* – ROTAP Conservation Status: 2RC-

2RC-: 2 = localized within a restricted geographic area; R = at least one population known to occur within secure habitat, C- = population size within reserves unknown.

ii) Threatened Species

Green-leaved Rose Walnut¹ *Endiandra muelleri* - listed as **Endangered** for purposes of NSW Government's *Threatened Species Conservation Act 1995*.

Rough-shelled Bush Nut³ *Macadamia tetraphylla* - listed as **Vulnerable** for purposes of NSW Government's *Threatened Species Conservation Act 1995*.

Fauna

i) Threatened Species

Invertebrates

No threatened Invertebrates have thus far been recorded from within the balance landholdings.

Amphibians

No threatened Amphibians have thus far been recorded from within the balance landholdings.

Reptiles

No threatened Reptiles have thus far been recorded from within the balance landholdings.

Birds

White-eared Monarch^{1,2} *Monarcha leucotis* - listed as **Vulnerable** for purposes of NSW Government's *Threatened Species Conservation Act 1995*.

Rose-crowned Fruit Dove^{1,2} *Ptilinopus regina* - listed as **Vulnerable** for purposes of NSW Government's *Threatened Species Conservation Act 1995*.

Mammals

Coastal Planigale^{1,2} *Planigale maculata* - listed as **Vulnerable** for purposes of NSW Government's *Threatened Species Conservation Act 1995*.

Koala^{1,2,4} *Phascolarctos cinereus* - listed as **Vulnerable** for purposes of NSW Government's *Threatened Species Conservation Act 1995*. Population status is unknown but sightings over last decade suggest presence of small and widely dispersed population within the balance landholdings.

Grey-headed Flying Fox¹ *Pteropus poliocephalus* – listed as **Vulnerable** for purposes of both the NSW Government's *Threatened Species Conservation Act 1995* and the Commonwealth Government's *Environmental Protection and Biodiversity Conservation Act 1999*.

Sources: ¹Gilmore and Milledge (1984); ²NSW Wildlife Atlas; ³Biolink; ⁴Kerry MacMunn (Inter-Active).

Threatened species records for the study area (where known) are detailed in Figure 3.

ii) Endangered Ecological Communities (EECs)

(a) *Lowland Subtropical Rainforest on Floodplain (LSTRF) in the North Coast Bioregion* is listed as an EEC for purposes of the NSW Government's *Threatened Species Conservation Act 1995*. LSTRF occurs along lower elevation drainage lines and/or alluvial terraces in several locations within the balance landholdings, the largest of which is located to the west of Central Hill (see Fig. 2).

(b) *River flat Eucalypt forest on Coastal Floodplains (RFEFCF) of the NSW North Coast, Sydney Basin and S/E corner bioregions* is listed as an EEC for purposes of the NSW Government's *Threatened Species Conservation Act 1995*. Relic RFEFCF occurs in patches along the Tweed River, including the riparian zone within the proposed village planning precinct.

iii) Kunghurloo Creek

Kunghurloo Creek bisects the balance landholdings as a northeasterly draining, third order stream that has its headwaters in the adjoining Mebbin National Park. This particular watercourse is an important ecological feature of the balance landholdings. Unfortunately, historical land uses have compromised the visual amenity and integrity of this watercourse by excessive clearing within the riparian zone that has facilitated weed invasion in many areas.

3. Existing Use

The study area has a long history of use that has predominantly focused on timber harvesting, silviculture and beef cattle grazing. As testimony to this history, a relic sawmill and associated infra-structure still remain at Central Hill (Fig. 4), elements of which potentially lend themselves to future use for educational purposes. Current landuse activities include cattle grazing, plantation forestry and educational activities. Field inspections also confirm that the juxtaposition of the balance landholdings with the adjoining national park estate results in a flow over of recreational pursuits such as bush walking and less desirably - trail bike riding. Moreover, the two properties share common access/egress points in the form of Lemon Tree and Walter's Roads,

and joint interests for the purposes of bushfire management. Hence the NSW National Parks and Wildlife Service is a key stakeholder with specific interests in longer-term management of the study area generally, aspects of which are discussed in more detail below.



Figure 4. Relic sawmill at Central Hill within the balance landholdings. A potential interpretive resource?

i) Plantation Forestry

Approx 80ha of the site are currently devoted to plantation forestry (see Fig 2). These plantations were originally established in 1995 through a joint agreement between the then landholder and State Forests of NSW, with sites planted to a mix of predominately *Eucalyptus grandis* (Flooded or Rose Gum), *E. dunnii* (White Gum) and *E. pilularis* (Blackbutt).

ii) Educational Activities

A local company - Inter-Active Pty. Ltd. - currently provides a range of outdoor activities for primary and secondary school children, the focus being on nature-based activities, individual character development and team building. The company is in the process of purchasing a small area of the balance landholdings and maintains a financial agreement with the current owner for ongoing use of some areas of the site. Key areas of interest for

Inter-Active include the Tallowwoods and Muddy Dams (canoeing), Central Hill (camping and ropes course) and an area known as the Pinnacle Spur (ropes course). A number of informal walking tracks within the forested, southeastern portions of the balance landholdings also cater to orienteering activities while also linking each of the abovementioned areas.

iii) National Parks and Wildlife Service

Various locations within the study area offer expansive views of the surrounding World Heritage listed national park estate including Nightcap and Mt. Jerusalem National Parks to the east-southeast, Mt. Warning National Park to the north and the Border Ranges National Park to the west-southwest, while the western boundary of the balance landholdings directly adjoins Mebbin National Park. Management of these natural areas is essentially governed by the *Parks and Reserves of the Tweed Caldera Plan of Management* (NPWS 2004). Issues arising from this Plan of Management (PoM) that are of relevance to the balance landholdings include the following:

a) Lemon Tree Road

Lemon Tree Road enters the balance landholdings from the southwest and hence provides direct access into and out of Mebbin National Park. The PoM initially proposed that this road be maintained as a 4WD dry-weather only road to the vicinity of a tree known as the Giant Ironbark. The Giant Ironbark died in 2004, thus necessitating a review of this provision. Based on discussions with local DEC staff, Lemon Tree Road is now proposed to be retained for management purposes only.

b) Walter's Road

Walter's Road enters the balance landholdings from the northwest and also provides a direct access into and out of Mebbin National Park. Walter's Road and Lemon Tree Road are connected by an internal track within the balance landholdings and field inspections suggest regular use of this link by trail bike riders and 4WD vehicles. Based on discussions with local DEC staff, Walter's Road is also proposed to be retained for management purposes only.

c) Cutters Camp

Cutter's Camp is the primary visitor facility in Mebbin National Park and functions as a picnic/camping area. Cutter's Camp is located within 1km of the extreme northwestern corner (i.e. Walter's Corner) of the balance landholdings. From Cutter's Camp there is a small (~ 400m) walking track that winds down to Byrrill Creek. The PoM specifies a maximum camping limit of 20 persons for the camping area and also proposes to extend the existing walking track to create a loop walk.

4. The Integration Concept

Rarely does an opportunity present itself to effectively integrate a proposed new village with a change to surrounding landuse such that it has the potential to enhance the proposed community's lifestyle, provide important employment opportunities and generally promote more ecologically sustainable land use practices. Detailed below is a conceptual basis for achieving such an outcome, balanced necessarily in favour of ecosystem recovery and conservation but otherwise inferring the need for some form of supporting development within the balance landholdings.

a) The Village Precinct

The Nightcap Village proposal has the potential to establish benchmark standards in terms of the application of ESD principles within the Tweed LGA. Thus it will be important that the planning process demonstrate a commitment to ecologically sustainable development objectives in terms of underlying design principles, water management, waste recycling and the maintenance/enhancement of biodiversity values and essential ecological processes. Some underlying principles that might guide this process include:-

- novel methods of waste recycling and on-site management/provision of potable water resources,
- demonstrable use of alternative energy sources,
- emphasis on passive forms of intra-village connectivity, including pedestrian pathways and/or cycleways,
- emphasis on open space and retention of native vegetation with *post-development* landscaping making exclusive use of native species likely to occur naturally on the site and/or endemic to the Tweed Valley, and
- prohibiting the keeping of domestic dogs and cats within the village precinct.

Remaining patches of vegetation that currently buffer the Tweed River are important in terms of providing visual amenity and assisting essential ecological processes (maintenance of water quality in the Tweed River generally), while also having conservation and biodiversity value(s) in their own right. Hence there is a need to ensure that this area is effectively buffered against adverse impacts arising from development in the village area. The

riparian zone is also likely to be a focal point of community interest for both passive recreation and rehabilitation purposes. From this perspective, the following actions are proposed for consideration:

- incorporation of controlled pedestrian access into the riparian zone, presumably by way of a feature boardwalk with occasional viewing platforms at appropriate vantage points, and
- as a condition of any development consent, preparation of a management plan to guide longer-term rehabilitation of the riparian area.

The Balance Landholdings

The balance landholdings present a number of opportunities for consideration that, collectively, can only serve to enhance the village concept. Foremost of these are opportunities for eco-tourism, consistent with the Plan of Management for the Tweed Caldera Parks and Reserves (NPWS 2004) that also promotes the need for alternative visitor opportunities in the Tweed region to reduce perceived visitor pressure(s) on national park estate and especially on Mt. Warning National Park which receives in excess of 100,000 visitors per annum.

Notwithstanding the history of disturbance, the balance landholdings contain a number of significant ecological areas including Endangered Ecological Communities. A number of threatened species have been recorded from the site, the list is not comprehensive and additional species can be expected to occur, especially given the proximity of the adjoining Mebbin National Park. Opportunities are thus available to take pressure of the national park estate by offering a variety of alternative nature-based experiences as follows:

Walter's Corner

Walter's Corner is located in the northwestern corner of the balance landholdings in relatively close proximity to Cutter's Camp. Unfortunately, ill-advised clearing over time has reduced the visual and ecological amenity of this area such that the riparian zone is weed infested and extensive rehabilitation works will be required in order to to create a visually aesthetic

setting. Nonetheless, the site has potential to provide alternative accommodation in a natural setting (camping, cabins, day use facilities).

Rainforest Picnic Area

A small clearing adjacent to the area of LSTRF located to the west of Central Hill offers a potential day-use area in a visually appealing setting that has important conservation values.

Central Hill Eco-tourism Precinct

This area is, as its name implies, centrally located within the balance landholdings and offers expansive views* of Mt. Warning and the surrounding caldera rim. Importantly, the site is largely cleared and thus has the potential to serve as a focal point for activities within the balance landholdings while also offering additional nature-based eco-tourism and educational opportunities, elements of which might include:

a) Field Study Centre

Such a centre could provide resources and establishment of educational programs focused on research/monitoring of fauna, flora and other biodiversity issues, plantation forestry. A wide target audience is likely including primary, secondary and tertiary educational institutions.

b) Conference Facilities

The Tweed region is poorly serviced in terms of conference venues in a natural setting, in close proximity to adjoining World Heritage listed national parks and that can offer a variety of ancillary activities.

c) Motel/Cabin & Camping

In support of a) and b) above, the Central Hill precinct is also large enough to provide a variety of accommodation opportunities from motel/self-contained cabin type accommodation to river flat camping areas.

* see cover photograph

d) Walking track network

A linked, walking track network is envisaged that offers access to Walter's Corner, the Rainforest area and other areas/sites of interest within the balance landholdings, thus providing walks of both short and longer duration with possible links into the adjoining national park(s). Preliminary field work indicates that it will be possible to connect each of the above proposals with a high quality walking trail network with a maximum gradient of between 0 – 5 degrees.

e) Trail riding

Trail riding using either horses or mountain bikes is an increasingly popular passive recreational activity, both of which could be catered for on the network of tracks that occur within the balance landholdings.

f) Internal Road/Track Network

The balance landholdings contain an extensive network of roads and tracks that essentially reflect both past and present landuse activities (Fig. 5). Consistent with the concepts presented herein would be a requirement to consolidate the existing track network in order to provide a 2WD dry-weather only circuit road that is clearly linked to the village precinct. The end result of this proposal would see some of the existing track network closed and allowed to regenerate, with those tracks remaining to be designated and managed as either:

- (i) 4wd and/or horse and/or bicycle dry weather only, and
- (ii) Pedestrian access (bushwalking) trails only.

Implications

In accord with the above, regular maintenance, provision for drainage works and upgrading of creek crossings will be required in a number of locations. Site specific rehabilitation and concept plans required for Walter's Corner, the Rainforest patch and the proposed Central Hill Eco-tourism precinct will also need to be developed. The long-term outcome envisaged within this document (Figure 6) is for an alternative land use scenario that would see approximately 60 - 70% of the balance landholdings dedicated to conservation

and eco-tourism pursuits, with the remaining 30 - 40% potentially devoted to plantation forestry. From this perspective, the potential benefits for a village in context with its surroundings should be readily apparent.

5. Issues & Recommendations

Preceding sections have raised various issues associated with past, current and future landuse practices within the study area generally, and the balance landholdings in particular. With regard to the latter, below we have attempted to elaborate on these problems/issues in much the same order as the information from which they originate, while also providing a related series of preliminary recommendations as follows:

1. Planning context

- The balance landholdings are currently zoned 1(a) Rural. Any material change in landuse activities, such as those proposed in this report, may require specific planning approvals and/or be inconsistent with the current zoning.

Recommendation No. 1: the landowner should liaise with Tweed Shire Council administrators and planners to seek approval in principle for the material changes in landuse outlined in this report and, if this is forthcoming, seek formal advice on planning implications.

Recommendation No. 2: subject to approval in principle being obtained from TSC, a detailed site/concept plan for the Central Hill Eco-tourism precinct and associated developments should be prepared.

2. The Natural Environment

- Available knowledge on flora/fauna and ecological communities of interest is scant and both the study area and longer-term management interests can only benefit from additional flora/fauna survey work and more detailed mapping/assessment of vegetation communities. The relatively large areas of sclerophyll forest have excellent recovery

potential (in terms of increasing overall species richness) given the proximity and known biodiversity values of the adjoining Mebbin National Park. The presence of an EEC within the village planning precinct will need to be taken into account.

Recommendation No. 3: in order to further refine alternative land use opportunities, additional flora/fauna survey work and associated vegetation mapping should be undertaken within the balance landholdings.

Recommendation No. 4: that, with the exception of works required for the management of areas devoted to forestry plantations, no further logging be permitted within the balance landholdings.

- Historical land uses and associated land clearing activities have had a detrimental effect on the water quality and ecological integrity of Khungurloo Creek. The riparian zone is weed infested in many areas such that extensive rehabilitation works will be required in order to restore visual amenity and ecological values. Alternative land use opportunities within the balance landholdings will need to be considered in the context of their potential for indirect downstream impacts (i.e. increasing siltation, turbidity).

Recommendation No. 5: Ongoing land use management practices within the balance landholdings should impose mandatory 10 - 15m non-disturbance buffers on both sides of all first and second order drainage lines and/or streams, in addition to a minimum 30m non-disturbance buffer on both sides of Khungurloo Creek.

Recommendation No. 6: Preparation of a management plan to address the issue of gradual rehabilitation of degraded riparian areas in both the balance landholdings and village precinct would be desirable, and should ultimately prove useful/instrumental in seeking external funds to undertake such work.

3. Existing Use

- Plantation Forestry is arguably the future of Australian hardwood production and further serves as a demonstrably ecologically sustainable landuse if properly managed; hence areas under plantation can serve as an important educational resource, while also providing long-term research and monitoring opportunities. A reasonable measure of vehicular access to plantations must be maintained. Other currently cleared areas of the balance landholdings, especially in the northeast, potentially lend themselves to this form of landuse.

Recommendation No. 7: The potential for establishment of additional plantation forestry areas, particularly in the northeast of the balance landholdings should be explored by the landowner.

- The site proposed for purchase by Inter-Active will need to be effectively buffered/screened from the proposed village site in order to maintain the illusion of remoteness in a bushland setting. Ongoing needs for access by Inter-Active to the areas mentioned in 2 above will also need to be carefully managed so as to avoid any conflicts with future use of the balance landholdings.

Recommendation No. 8: Liaison between the landowner and Inter-Active Pty. Ltd is required with a view to the planting of an effective buffer of native vegetation in order to screen the proposed village site ASAP.

4. National Parks

- Both Lemon Tree Road and Walter's Road currently function as unmanaged access points through both the Mebbin National Park and the balance landholdings; inspections reveal that both roads are regularly utilized by trail-bike riders and/or 4WD vehicles. Both roads also have strategic importance for bush fire fighting purposes and, in association with the primary north-south track that links them within the balance landholdings, should be managed for this purpose. On-site

inspections with DEC staff have identified suitable locations on both Lemon Tree Road and Walter's Road at which locked access gates could be installed.

Recommendation No. 9: Ongoing liaison with local DEC staff regarding control of access, the installation of appropriate signposting and joint fire management interests is warranted.

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